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RADIOLOGY: THE PAST AND THE FUTURE.[1]

By H. M. HEWLETT, M.B., B.S. (Melbourne), M.R.C.P. (Edinburgh),

Honorary Consulting Radiologist, Children's Hospital and Saint Vincent's Hospital, Melbourne.

I HAVE to thank the executive of the Australian and New Zealand Association of Radiologists for the honour they have conferred on me in requesting me to give the first annual address.

To one who, like myself, has been closely associated with radiology from its beginning, the subject for such an address suggests itself. Having watched our specialty through each phase of its development, seeing it grow from faltering infancy to robust adult life, I felt I could not do better than to recall significant events in its history and offer a few suggestions regarding its future. To you and me radiology is a fascinating study; but we never forget that its value is the contribution it makes to the noblest aim of all—the saving of human life, the conquest of human suffering.

It is not yet forty-three years since William Conrad Röntgen, Professor of Physics in the University of Wurzburg, in Bavaria, experimenting with an induction coil and a Crookes tube carefully screened by black cardboard, noticed that when the tube was energized a piece of cardboard painted with platino-cyanide of barium became luminous. The discovery was communicated to the Wurzburg Physico-Medical Society in December, 1895, in a paper entitled "On a New Kind of Ray". His first lecture on the rays was given before the society on January 23, 1896.

[1] The first annual lecture of the Australian and New Zealand Association of Radiology, delivered before a meeting of the association on April 7, 1938.

The first notes I can find of the discovery in the medical Press are in *The Lancet* and *The British Medical Journal* of the same date, January 18, 1896.

In *The British Medical Journal* Professor Schuster, of the Physics Department in the University of Manchester, draws attention to the inaccurate statements in the daily Press and notes that the new radiation could not be refracted or reflected. In the next issue a reproduction from a negative of the hand is printed, and a similar print also appears in *The Lancet* of the same date, these being the first examples of X ray photography reproduced in British medical journals. In the issue of February 8, 1896, the first of a series of articles by Sydney Rowland on the application of the new photography to medicine and surgery appeared; the series continued for some months. Even in the first communication the possibility of showing gall-stones and urinary calculi was proclaimed. A Viennese professor was apparently the first medical man to use the new discovery in surgery. This was the removal of a supernumerary phalanx from the great toe. The second case was the removal of a bullet from the hand.

In the first few weeks of its application many famous names appear. Von Bergmann removed bullets from the hand after localization by X rays. Oliver Lodge demonstrated a bullet in the forearm of a patient of Robert Jones, who subsequently removed it.

At first there was great difficulty in obtaining Crookes tubes in London, and most of the work was done with five-inch or six-inch coils and bichromate batteries. None of the tubes had a stable vacuum; it was either too high or too low, and it was good fortune if one got a tube suitable to the outfit available.

Early in March, 1896, a great advance was made. Hitherto the X rays were obtained by the cathode rays striking the walls of the tube. In that month Newton and Company introduced the focus tube, obtaining a definite point of origin for the X rays; the resulting radiographs were consequently much sharper. With the introduction of the focus tube deeper structures were revealed, and in the issue of *The British Medical Journal* of March 28, 1896, is a large reproduction of most of a three months' infant's trunk, showing the spine and heart shadow. The tube was eight inches from the plate and the exposure was of fourteen minutes.

In one of the issues of *The British Medical Journal* of May, 1896, there is a letter by Swinton Campbell on improvements in Röntgen photography. He draws attention to obtaining good results and yet reducing the exposure time and mentions the making of the first screens coated with platino-cyanide of barium. These were coarse and granular, and he obtained better results with tungstate of calcium. With this apparatus Swinton Campbell was able to reduce the exposure to show the bones of the hand from one or two minutes to five or ten seconds. To reduce the exposure time he also experimented with mixing tungstate of calcium with the photographic emulsion before it was applied to the glass plate. This made the plate more sensitive to the rays; but there was granularity. He also, as early as this, drew attention to the necessity of close contact between the screen and the plate.

It is strange that *The Medical Annual* of 1897 makes no special mention of X rays in its review of the new inventions and discoveries of the year. In the publication there is, however, an advertisement of Archibald J. Wright, of Farringdon Road, London, mentioning Röntgen X ray apparatus, but without any particulars or prices. In the same volume More Madden, in an article on the disorders of pregnancy, states that in the experiments with Röntgen rays upon pregnant mothers, made in February, 1896, it was quite possible to obtain an outline of the living fœtus in the body of the mother. In the same issue of the annual attention is drawn to its uses in laryngology, and the article illustrates a lost intubation tube in the trachea.

The first notes of the new discovery I could find in *The Intercolonial Medical Journal of Australasia* were in the issue of June 20, 1896. Here Professor Lyle, Professor of Natural Philosophy in Melbourne University, showed a Röntgen ray photograph of a foot in which a small fragment of a needle was revealed. The fragment was very indistinct and overlooked at first, but eventually was removed by operation. In the same number there are notes of a meeting at which the late Dr. F. J. Clendinnen, of Melbourne, showed a number of Röntgen photographs. A month later more photographs were shown by the same member, and at the August meeting he read some notes on the Röntgen rays and gave a practical demonstration. He pointed out that Professor Röntgen's discovery was accidental and that he simply completed the labours of others, roofing the house where the foundations had been laid and the walls built by Hirtz, Lenard, Crookes, Hittorf and others. Without detracting from Röntgen, it must be admitted that without the previous experiments of those named his discovery would not have occurred.

Sir George Gabriel Stokes, an Irishman, Professor of Mathematics at Cambridge, must not be overlooked, as he was the first to demonstrate that a large number of solid bodies and solutions possessed the power of absorbing various wave-lengths of light and then instantly emitting light, always with an increase of wave-length. This phenomenon of fluorescence was of importance to Röntgen, as he was able to conclude that the completely covered discharge tube must be generating an invisible light of extremely short wave-length.

The first notice of the new discovery in the English lay Press was in the London *Standard* of January 7, 1896. The article was headed "Photographic Discovery", and was evidently contributed from Vienna. It stated that a very important scientific discovery had recently been made by Professor Röntgen, of Wurzburg University. He used the light emitted from one of Crookes's vacuum tubes through which an electric current was passed to act upon an ordinary photographic plate. The

invisible light ray, of the existence of which there was already ample evidence, showed this peculiarity that thin wood and various organic substances were transparent, whilst metals and bones, human and animal alike, were opaque to it. The article went on to state there were photographs already in Vienna showing the bones of the hand, and they were ghastly enough in appearance, but from a scientific point of view they opened up a wide field of speculation. It also mentioned some of the possible uses of the new photography, and concluded by assuring its readers that there was no joke or humbug in the matter and that it was a serious discovery by a serious German professor.

The first note I can find in the London *Times* is in the issue of February 4, 1896. It was a leading article entitled "A New Mode of Motion". The *Times* was evidently conservative, as it had not alluded to the discovery before, yet it mentioned that no illustrated paper was complete without a picture showing the transparency of the human hand. It also said that physicians already dreamt of unheard-of cures by its agency, and that the market price of exhausted tubes was rapidly rising.

In our local lay Press the first note of the discovery appears in the Melbourne *Age* of February 15, 1896. This is virtually the same as the article in *The Standard*. It speaks of the spirit of photography of Professor Röntgen. The article goes on to say the new discovery will be useful for treating caries and other diseases of bone.

In *The Age* of February 27, 1896, there is a leading article on the subject. After mentioning the visibility of coins in a box and bullets in a body, it states that it is only a step to complete photography of every morbidity in the human corpus, and instead of Æsculapius with his probe torturing his victim in order to locate the seat and nature of his sufferings, he will soon have to do nothing more than place his patient in a bath of photographic light and all will be as transparent as the day: "A light that never was on sea or earth. The consecration of the poet's dream."

About this time London *Punch* had some amusing illustrations about the discovery. In the issue of March 7 there is a sketch of a ghost-like figure with its head against the keyhole of the door, also faintly outlined, and the caption is: "Interesting results obtained with aid of Röntgen rays by a first floor lodger when photographing his sitting room door." In the issue of April 25 there is an illustration entitled "A Study in Anatomy". It shows a very thin horse with the ribs sticking out and near by a horse dealer with a prospective purchaser. The dealer, pointing to the horse, is saying: "That's what I call a picture." Prospective buyer: "Yes, he does rather suggest one of those Röntgen ray photographs."

In the United States Press the first notes of the discovery appeared in the New York *Sun* on January 11, 1896, under the title "Illuminated Tissues". It was a cable announcing Professor Röntgen's discovery, and went on to state that the new rays penetrated organic matter and other opaque substances just as ordinary rays penetrated glass. The daily papers were filled with all sorts of reports, correct and fantastic. Some went to the length of seriously explaining how at the College of Physicians and Surgeons, New York, the Röntgen rays were used to reflect anatomical diagrams directly into the brains of medical students, making much more enduring impressions than the ordinary methods of learning anatomical detail. Within a period of a few months five books were written in America on the subject. One of the best known of these was "The X-rays", by W. J. Morton, a well-known New York physician. Among my interesting possessions is a copy of the first edition.

My personal association with radiology began over forty-one years ago. At the end of 1896 I had been appointed to the staff of the Melbourne Children's Hospital. I was always keenly interested in photography and electricity, and the late Dr. William Snowball suggested that I take up the new photography, as it was then called. We obtained a small coil with a very small spark gap and the ordinary flapper break, and our source of current was a battery of large bichromate cells. We then looked for a location for the apparatus, and eventually I was installed in a corner of the mortuary with a cloth screen separating me from the mortuary tables and occasional cadavers. This was the humble beginning of an X ray department. In Melbourne the "eyes of a hospital", as X rays have been aptly called, started to see in lowly surroundings.

Later on a new mortuary was built and we were again located in that building, but this time in a separate room. After some years we were shifted to the basement of one of the large blocks, and although we had more space, there was a concrete floor and very low metal ceiling. Nowadays the X ray department of the Melbourne Children's Hospital occupies almost the whole floor of one of the large new blocks, and has spacious rooms and all conveniences.

When I began practical work the tube had been improved by Harrison, and, although only about the size of a tennis ball, it had a thin platinum anticathode. Our apparatus was primitive. Under favourable conditions we could obtain an output of half to one milliampère. Of course we used only the ordinary photographic plate, and my favourite was the "Imperial". There were no means of testing the penetration, and for years I would put my hand in front of the platino-cyanide of barium screen in order to judge the character of the ray. If it was too soft we had to reverse the current and if too hard reduce the vacuum by heating the tube with a spirit lamp.

Our exposures at that time for a hand would be from three to four minutes. For a spine or kidney I have frequently given an exposure of half an hour. Owing to breathing and movement the resulting plate was frequently a blur, so that a great deal

was left to the imagination when the appearances were interpreted. Occasionally the battery would run down during the exposure and the solution had to be replaced or more cells added. Also the vacuum of the tube did not remain constant. Numerous examinations had to be repeated, and consequently burns were frequent. Data collected in the early days showed that an acute dermatitis occurred about once in 1,300 cases and some of the burns were most extensive. It is no wonder that many of the patients referred to us at that time were "gun-shy". Many years were to pass before the average citizen failed to talk of burns when an X ray examination was suggested.

One of the advantages of the early days was the trifling cost of a complete outfit. I think my first equipment cost only about £25. The tubes could be obtained for about 27s. 6d. We had a wooden tube stand and an ordinary deal table. We had no overhead gear, and bare wires connected the tube. Later on I designed a wooden table and tube box which could be used either vertically or horizontally.

We had no developing tanks at that time, and all the plates had to developed by hand in dishes. Our fingers got dreadfully stained and were frequently cut. They were busy days. At that time I was in charge of a large out-patient department. After the morning's work I had to make my exposures of the various cases and come back at night and develop the plates, as I had no assistant, and technicians were unthought of.

The method of examining the gastro-intestinal tract by the opaque or bismuth meal was introduced about 1907; but three or four years previously I had attempted to show the size of the stomach in one of my patients who had the signs and symptoms of gastric dilatation. I asked the late Dr. J. F. Wilkinson to see him in consultation with me. He agreed with the diagnosis, but wished to confirm it and drew my attention to an article in a recent medical journal which stated that if a large gelatin capsule containing ten grains of a bismuth salt was swallowed the position of the lowest part of the greater curvature could be determined. We attempted this procedure one evening, but as our patient was a very stout man we had to strain our imaginations to confirm the diagnosis.

Although the opaque meal was introduced about 1907, very little use was made of it at first, as the results were most unsatisfactory. This was largely due to primitive apparatus and the poor density of the meal, as we generally used about thirty grains of bismuth carbonate or oxychloride in a basin of bread and milk or porridge. People were afraid of bismuth meals at that time as it was thought that bismuth salts might contain some arsenical salts. In fact some cases of arsenical poisoning followed some of these examinations. We were able to make plates of a kind, as intensifying screens had been introduced; but they were used singly and were coarse and granular. At that time we did not pay much attention to the appearance and behaviour of the stomach after the first mouthful or two of the meal. When ulcer was suspected we screened very carefully when the stomach had emptied, looking for flecks of bismuth, as it was thought that the chief diagnostic point was the coating of the raw surface of the ulcer by the opaque salt. It was after this that Haudek pointed out that the fleck was the bismuth in a crater. Trouble also occurred when barium was first introduced, and there were several deaths from the use of the soluble barium salts, such as the sulphide. At that time I generally wrote my prescriptions thus:

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Barium sulph. ..... ʒii

On one occasion I gave such a prescription to a patient with instructions to bring the powder with him to my rooms when he came next morning, fasting. He duly arrived and gave the powder to my nurse, who noticed that in appearance and smell it seemed to be different from the usual powder. She drew my attention to it and it turned out to be barium sulphide. It was very fortunate the powder was not given at home as a six-hour motility meal. After that I always wrote "Barium sulphate (pure)" when the substance was required for internal use.

About 1910 I started doing opaque meal examinations fairly regularly, and they soon became very popular. My principal supporter at that time was the late Dr. J. F. Wilkinson, who was responsible for introducing to Melbourne, if not to Australia, the modern methods of gastro-intestinal investigations. Every few days he would arrive about 8.30 in the morning, bringing half a dozen patients with him, and we would examine them by the meal method, one after another. I would examine perhaps two or three other patients after opaque meals and then go on to one of the general hospitals. I have done as many as a dozen or more such cases there in a morning. I now have notes of about 20,000 meal examinations done privately. I thought I was working very hard at that time; but Dr. Colin Macdonald, who has recently returned from the United States of America, informs me he saw Dr. Kirklin and Dr. Weber at the Mayo Clinic do fifty-three meal examinations between them in the one day. The history having been taken previously, the patient was ushered into the screening room, a swallow of barium was given, the stomach was washed and carefully inspected, and then filled and again examined. After that the patient was sent to another room, where serial films in oblique positions were made. I quite agree with the use of the lateral oblique position, and consider that such a position, especially when serials are made, is the most useful for the investigation of pyloric and duodenal lesions. It seems a very quick method for such an examination, as I now always take about half an hour for the first investigation and nearly always use the single-meal method. I find this less confusing than the double meal. However, I was assured that both Dr. Kirklin and Dr. Weber are very skilful and that very few mistakes are made at the Mayo Clinic. Radiologists the world over

owe a great debt to the work of the late Russell Carman and his successors.

For some years before the Great War steady improvement in apparatus and technique had been taking place. Better plates with special emulsions had been introduced, and coils were much larger and interrupters had improved.

About 1913 I got a twenty-inch Cox coil. It cost about £120, and I was able to do very quick work; but there was always trouble with reverse current. At that time I occasionally made a very quick exposure for a film of the thorax at about three feet distance by simply putting a very heavy current through with a light fuse wire in the circuit and blowing it. I used this Cox coil with my first Coolidge tube at the end of 1914. This was the first tube of its kind which came to Australia. There was only one pattern at that time and my tube was numbered 108. Now there are numerous types and patterns of Coolidge tubes and such types probably run into scores of thousands. Professor Laby, of Melbourne University, helped me considerably at first with this new tube; but we had a great deal of trouble. For the filament current we used a battery of accumulators insulated from the ground, and it was a nuisance keeping the cells charged. Occasionally when an examination was being made the battery would run down and the cells had to be recharged. Fortunately that was easy, as we had continuous current in Collins Street, and it needed only a series of carbon filament lamps in the circuit.

I had this original tube for about three years. The cathode wires were enclosed in a separate glass tube, which eventually broke. This caused the filament to sag, and consequently it did not focus properly. The price of the universal Coolidge tube at that time was only £25. This was fortunate as in less than a year I punctured about six of them. The lead rubber lining of my tube box became loose and I instructed one of the local firms to repair it. Instead of cementing it they nailed it down; consequently sparks to the tube occasionally occurred, with disastrous results. It has been said that a puncture is a trifle, a trifle is a scrap, a scrap is a fight, a fight is a battle, a battle is war and war is hell. That well describes the punctures of X ray tubes in the early days. It was good to be a pioneer, but it was very expensive.

A few years after this I obtained my first Victor Snook transformer; as we had continuous current I had to work with a rotary converter, and it was very noisy. Consequently I did all my screening with the Cox coil and threw in the transformer by a high-tension switch when I wanted to make a plate or film. Films had been introduced by that time and were a blessing, both in developing and storing, although the danger of fire was always present.

Many people think that X rays were introduced about the time of the Great War. It is true that a great impetus was given to radiology during those years, especially in the investigation of bone injuries and the localization of foreign bodies. Thereafter the rays were much more frequently used in general practice, a large number of medical men having gained practical experience in their uses at the front. Also there was a great improvement in equipment. Bucky had come along with the fixed grid, but Potter suggested the moving curved grid, and the results obtained, especially in Röntgenography of stout people and deeply seated parts, were amazing. Improvement then progressed along the chemical lines, opaque solutions and oils being used to demonstrate the pelvis of the kidney, the bronchi, Fallopian tubes, salivary ducts and so on.

About fourteen years ago Graham and Cole introduced cholecystography, which has been of inestimable help in many dyspeptic conditions. I consider its chief use is in demonstrating gall-stones, and to a lesser extent in indicating the function of the gall-bladder.

In the early days of cholecystography the oral method came into great disfavour and the intravenous administration of the dye was considered the only effective method. This was very inconvenient as the preparation of the solution was troublesome. Formerly an inconclusive examination after the oral administration of the dye had always to be checked by examination after intravenous injection; but nowadays the administration of the dye by the mouth gives all the information required.

It is very interesting to look over old issues of *The Medical Annual*. In that of 1899 I find the first reference to an X ray meter. Many cases of dermatitis had occurred from the hand being placed in front of the fluorescent screen to indicate the penetration of the rays. Dr. Wolfenden pointed out that a meter to gauge the penetration could be easily made by taking a small piece of cardboard and dividing it into 32 squares and then covering the squares with increasing layers of tinfoil, and in addition placing small lead numbers on each square. Number 1 square would have one layer of tinfoil, number 2 two layers, and so on up to number 32. On holding this between the tube and the screen a measure of the degree of penetration could be obtained. This was the forerunner of the old familiar penetrometer, made of a wedge of aluminium or steps of aluminium, with a thin strip of silver superimposed and having numbers cut in it.

In *The Medical Annual* of 1900 there is a review of radiography during the preceding year in which the first mention is made of X rays in war. X rays had been used in the Soudan and in some of the Indian campaigns. After the battle of Omdurman there were 21 cases out of 121 wounded in which the bullet could not be detected by ordinary means, and in 20 cases an accurate diagnosis was made by X rays, the other patient being too ill for examination. During the war in the Soudan accumulators and coils were used, the accumulators being charged from a small dynamo driven by a tandem bicycle. Previous to this year it had been thought that X rays had a beneficial action on tuberculous foci in the lungs; but a couple of French physicians did some experimental work on tubercle bacilli and con-

cluded that animals infected with tuberculosis in various ways and subjected for more or less prolonged periods to the action of the rays died for the most part without appreciable modification of the lesions and without any retardation in the evolution of the disease.

As far back as 1901 X ray workers were growing very confident about the diagnosis of urinary calculi. Leonard, of Philadelphia, maintained that not only could a stone be recognized, but, what was as important, he could make certain that no stone was present. Where there is no evidence of stone there is none present.

According to *The Medical Annual* of 1903 most of the leading hospitals throughout the world had X ray departments, and there was a great boom in treatment, not only by X rays, but by high-frequency currents and Finsen light.

Even in those early days extensive use of X rays in pulmonary tuberculosis had led to the following conclusions: (i) in no single case in which physical signs were present did the X rays fail to detect mischief; (ii) in some cases in which no physical signs were detectable the rays showed deposits, and subsequently physical signs appeared; (iii) the rays frequently demonstrated that the disease was more extensive than the physical signs indicated.

From 1909 up to the beginning of the Great War there was steady improvement in technique and apparatus, the most notable being the introduction of the Coolidge tube in 1913. The improvement in technique and the introduction of barium sulphate for opaque meals afforded a help in the diagnosis of gastro-intestinal disorders, and numerous papers appeared on the X ray diagnosis of chronic appendicitis. Also during those years pyelography was carried out. At first it was always retrograde, the medium used being "Collargol", and I can well remember the dirty messes that were made when this silver salt was used. A method of using X rays to determine the digestive powers of the gastric juice was also introduced. The appendix of an animal was obtained and dissected, only the connective tissues being left. Within this was placed about one-third of an ounce of bismuth salicylate and the whole was swallowed. It was seen on the screen as a dense black isolated shadow. As soon as the coating of connective tissue was digested the powder would scatter, and the exact time of connective tissue digestion could be estimated.

During these years the dangers of X rays were pointed out by the British Electrotherapeutic Society, who sent the following resolution to the medical Press and to various members of parliament of both houses:

> It having been established that the use of X rays and other rays by persons without a registered qualification constitutes a grave social and public danger, and that medical men alone are capable of administrating such rays to the public benefit, this society is of the opinion that the use of the X ray and other rays should be, by Act of Parliament, confined absolutely to registered medical practitioners and to dental surgeons in the practice of dental surgery.

During the first few years of the Great War many methods of localizing foreign bodies were introduced and a great impetus was given to stereoscopy. At this period the rays became useful also in helping to stop the smuggling of rubber across the Atlantic. This contraband substance was frequently hidden in bales of waste. When officers had reason to suspect a bale it was examined fluoroscopically, and if a shadow was observed the bale would be opened.

About 1921 the University of Cambridge established the Diploma in Medical Radiology and Electrology, and shortly after the University of London established a professorship of radiology—a full-time post to be held in connexion with the medical school of the Middlesex Hospital.

About this time Barclay, in an address on "Ideals in Radiology", pointed out the growing responsibilities of the radiologist. He indicated in no uncertain manner that it was not now the duty of the expert in charge of a hospital department to take all the plates and make all the routine examinations; he could leave these to assistants, reserving for himself special research work, issuing reports, and consulting with other members of the hospital staff on patients sent for examination. Also he would be required to lecture to students and persons seeking post-graduate training.

The injection of air into the peritoneal cavity was introduced before 1922, but it was short-lived. It was excellent for delineating solid abdominal organs; but there were many accidents, such as intestinal puncture, puncture of omental and mesenteric blood vessels and abdominal viscera, peritonitis and air embolism; consequently it fell into disrepute.

About 1927, on account of numerous actions at law over accidents and injuries, a medical defence society saw fit to warn its members that in the treatment of all cases of fracture and suspected fracture it had become necessary that the medical attendant should invariably ask for and advise an X ray examination, and in cases of its being for any reason refused should obtain written evidence to that effect.

Reference to the law and courts reminds me that the judges and jury often have difficulty in understanding X ray films. One judge remarked that there were three kinds of lies: plain lies, damn lies, and X ray pictures. However, about twelve years ago Lord Moynihan, then Sir Berkeley Moynihan, when delivering the Mackenzie Davidson Memorial Lecture, said some very complimentary things about radiologists:

> The change from the old days with the hesitation, the guess work, the bitter and humiliating disappointments, to these days of confidence and precision is almost immeasurable, and it is to the devoted and skilful worker in the fields of radiology that we are grateful for the transformation.

To predict the future of radiology is most difficult. Apparatus and accessories have reached such a stage of perfection that there does not appear

to be any need for improvement there. There is decidedly no occasion to shorten exposure time. The detail with modern films and screens is now so nearly perfect that it is hard to imagine how it can be improved.

The best work in the future will probably be done in large hospitals where specially trained radiologists will have the advantage of help from the biochemists and pathologists, and some of the cases can be followed up to the *post mortem* room. Perhaps in private practice there will be a group such as a physician, a surgeon, a biochemist and pathologist, perhaps an expert in diseases of the nose and throat, and a radiologist. Unless the clientele of the group was very large there would not be sufficient work for the radiologist, and an equitable distribution of the fees would be most difficult to determine.

Already the universities of Sydney and Melbourne have taken steps to place the post-graduate teaching of radiology in Australia on a sound footing by the establishment of diplomas in both radiodiagnosis and radiotherapy.

I have frequently been asked by the parents of graduates just qualified or by the graduates themselves: "What is the best way to start radiology?" My advice invariably has been to endeavour to obtain a resident appointment for at least twelve months and then go into general practice for five years before attempting to start the specialty. By doing that one is much better able to know what is required of the investigation, get a better history, and give more help to the referring physician.

I am indebted to Dr. Colin Macdonald, who has just returned from America, for the following notes on the training of radiologists in the United States of America.

The Americans believe in getting a man working on the specialty as soon as he has finished two or three years as a resident medical officer in the general work of a hospital, preferably one associated with a university. He then applies for the resident position in the X ray department and may hold this for three years. The remuneration is very small, a bare living. He is really an apprentice to the head of the department, and is directly under his control, except when he is in the pathology department. In the first year he is principally occupied in learning X ray technique. In the second year about nine months are occupied in the pathology department, especially in examining the specimens which have passed through the radiological department. In the third year he does reporting and special examinations, like examination after opaque meals; but all his reports are checked by the director of radiology. This is necessary, as in most of the large X ray departments attached to university hospitals, both public hospital and private patients are examined. At the end of three years, during which time he has had instruction in physics, X ray technique, and in both radiodiagnosis and radiotherapeutics, he sits for the examination of the American Board of Radiology, which is controlled by the American Medical Association. If a man has his "American Board" as it is called, he is eligible for appointment as an assistant in an X ray department. A third-assistant gets the equivalent of about £400 a year, a second-assistant £600, and a first-assistant in a large department £1,000. There is considerable disparity between the incomes received by the directors of the department, who usually have the title of university professor, and the assistants, who may be regarded as employees of the director. The directors of radiology are on the following basis: (i) full-time, with a salary of up to £2,000 a year or more if connected with a large university hospital; (ii) receiving a fixed salary for diagnosis and treatment in hospital cases, and receiving a percentage of the earnings from private patients; (iii) the hire for private practice of the X ray department space from the hospital, for which privilege they have to examine and treat the hospital patients free. This arrangement appears to be the most desirable for hospital patients and radiologists alike.

The Americans pay great attention in all this post-graduate training to the apprenticeship concept, and in this respect the Diploma of the American Board of Radiology appears to be superior to radiological diplomas elsewhere.

In thinking of the future development of radiology, mention must be made of sectional radiography, although very little use has been made of it in Australia up to date. The principle of body section Röntgenography was first described by Bocage and applications for patent were made in France in 1921. Very little use of the discovery was made at first, although work was done with the apparatus and improvements were made. In 1935 Grossman made further refinements and called the apparatus a tomograph, under which name it is being manufactured and sold in Germany. A special study of the normal and pathological anatomy of the lungs, by means of Grossman's tomograph, has been made by Chaoul. This will mean that another costly, complicated and cumbersome apparatus will have to be added to our already overcrowded X ray departments.

One of the factors which is undermining the present status and future possibilities of Röntgenology as a specialty is the dumping of small X ray apparatus on the general medical practitioner by manufacturers. This is all very well in the case of country medical men for the diagnosis of fractures and simple problems and when they cannot avail themselves of the services of a specialist.

It must be emphasized that for successful radiological work a thorough and broad training in medicine and surgery is essential. The training must include pathology and anatomy, a good working knowledge of certain aspects of physics and chemistry, and much special instruction in positioning and in the making and interpreting of Röntgenograms. Fortunately in Australia we have very little competition from lay laboratories. They have

been a menace in many cities in the United States of America. There they are operated on a purely commercial basis by unqualified men who mostly have been assistants or technical assistants in X ray departments. These men not only make films, but have the impertinence to interpret them, and such interpretations are accepted by the referring physicians or surgeons who do not know the difference between pseudo-radiological service and the much more substantial assistance they might obtain from a well-trained radiologist. The X ray service is much more valuable if a consultation can be held and the clinical aspects of the case and the X ray findings discussed. The lay laboratories sell celluloid by the square inch instead of rendering medical consultation services.

In conclusion, I urge you all to recognize that, as radiology is a handmaiden of medicine and surgery of ever-increasing importance, we must do all in our power to maintain and improve its status as a definite medical specialty.

In my address tonight I have mentioned names that should be honoured in every community, names that are entitled to be enrolled among those of benefactors of mankind. To the pioneers of radiology and those who have devoted themselves selflessly to its development is due some share of that memorable and magnificent compliment paid by the American ambassador to Lord Lister on a famous occasion: "My Lord, it is not a profession, it is not a nation, it is humanity itself which with uncovered head salutes you." They, too, have done something for humanity's good. How much only the future can reveal.

THE RADIOLOGICAL EXAMINATION OF THE HEART.[1]

By L. E. ROTHSTADT, M.D., M.S. (Melbourne), M.R.C.P. (London),
Melbourne.

Historical.

IN 1896 F. H. Williams, of Boston, read a paper before the Association of American Physicians, and in it he indicated that by means of the fluoroscope it was possible to follow the auricular and ventricular contractions and that the position and size of the heart could be demonstrated. The application of fluoroscopy to the study of heart disease began on the Continent shortly afterwards, and soon literature on the subject began to appear. In 1901 Holzknecht published a book in which he showed a remarkable knowledge of the radiology of the heart. The first orthodiagraphic apparatus was constructed in Germany, and later Moritz showed that there was a relation between the appearances of orthodiagrams and the pathological modifications of the volume of the heart. In 1904 Köhler found that distortion and magnification of the heart's shadow could be almost avoided by taking radiograms at a distance so that the rays were nearly parallel; in this way teleradiography came into being. French physicians also used radiological methods in examination of the heart, and in 1913 Vaquez and Bordet published their monograph. Later, great interest in the subject was shown in America, and a large volume of literature grew up in that country. Until the last decade, however, British cardiologists did not use the method to any extent and the general attitude was indicated by Mackenzie, who in 1921 wrote in the "Oxford Medicine":

> The inspection and palpation of the movements of the heart and the percussion of the heart's dullness give a far more valuable indication of the size of the different chambers of the heart than an X-ray examination. Indeed, I am doubtful if an X-ray examination of the heart has ever thrown the slightest light on any cardiac condition. That the X-rays may reveal aneurysms and tumours, not perceptible to the unaided senses, is no doubt true, but so far as the heart itself is concerned, while it may give a more accurate conception of the size of the heart in bulk, it gives no idea of the particular parts that are increased in size.

In later years, as a result of improved apparatus and better technique, important contributions to knowledge have been made, and it is possible now to study the size of the individual chambers of the heart. Mackenzie's objection is valid no longer, and radiology has become valuable in the diagnosis of heart disease. Indeed, almost every first-class cardiologist is an enthusiastic fluoroscopist.

The Radiology of the Heart in Health.

The heart is very favourably placed for radiological examination, because, with the great vessels, it stands out as a dark shadow against the brightly illuminated lung fields. Three methods of examination of the heart by X rays will be discussed in this paper: (i) fluoroscopy, (ii) teleradiography, (iii) orthodiagraphy. Examination with the fluorescent screen should be carried out in every case. The rays are divergent from their source because of the small distance between tube and patient; therefore the shadow on the screen is enlarged and distorted and an exact measurement of the size of the heart and of its component chambers cannot be made. Nevertheless it is the most valuable of the radiological methods of examination, and usually the trained eye can decide if any chamber of the heart or great vessel is enlarged.

For teleradiography the target of the X ray tube is 1·8 metres (six feet) from the film. By this means the rays emitted are nearly parallel and the magnification is reduced to about 10% in the normal subject; but the larger the heart, the greater is the error. In order that comparison may be made with later films, exposures should be made under standard conditions, for example, in the same phase of respiration. Teleradiography may supply detail that is not obtainable by fluoroscopy. Teleradiograms are of value for record and research purposes and measurements can be made; but as a routine measurements are unnecessary and tables are not

[1] Read at a meeting of the Victorian Branch of the British Medical Association on April 6, 1938.

of great practical value, as the limits of normality are not easy to define.

An orthodiagram is the outline of the borders of the heart and great vessels, marked out by the use of a small beam of tangentially directed central rays of a freely movable tube; it shows the maximum size of each chamber of the heart and of each great vessel during the cardiac cycle. The shadows of the clavicles and the diaphragm are drawn in addition. An orthodiagram is more difficult to obtain than a teleradiogram; it requires more experience and, as it takes longer, there is more exposure of the examiner to X rays. Fluoroscopy and teleradiography are the methods usually employed in the radiological examination of the heart; but kymography is of value.

The patient is examined standing in the following positions: (i) Anterior—the patient faces the screen and the tube is behind him; (ii) right anterior oblique—the right shoulder is forward and the patient is facing approximately half-left and the

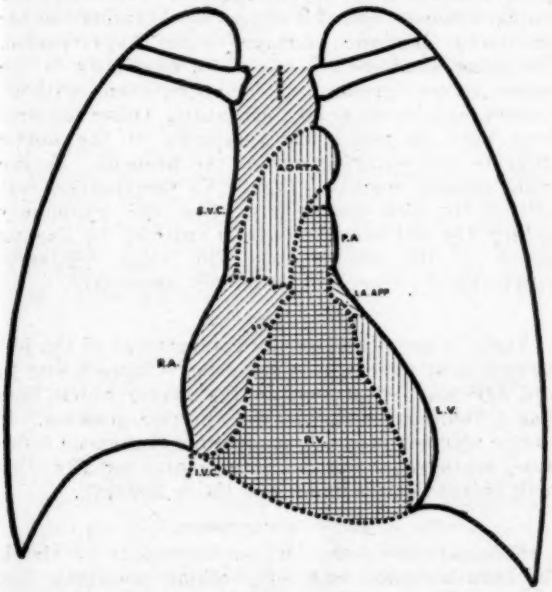

FIGURE I.
Diagrammatic representation of the radiological appearances of the heart from the anterior view. (After Parkinson and Bedford.)

screen; (iii) left anterior oblique—the left shoulder is forward and the patient is facing approximately half-right and the screen; (iv) lateral positions.

For the interpretation of X rays of the heart it is necessary to have a knowledge of the normal appearances in the various positions. In the anterior view (Figure I) the left border of the silhouette is formed from above downwards by: (i) the arch of the aorta as it turns backwards to become the descending aorta, (ii) the pulmonary artery, (iii) a small part of the conus of the right ventricle, and (iv) the left ventricle, which forms a considerable part of this border. The left auricular appendage may be interposed below the pulmonary artery. The right side is formed in the upper portion by the *superior vena cava*; but in later life the ascending aorta is visible in this region. An indentation follows, and the right auricle forms the remainder of the border down to the diaphragm. The caudal border of the heart is not visible unless there is considerable gas in the stomach, bowel or peritoneal cavity.

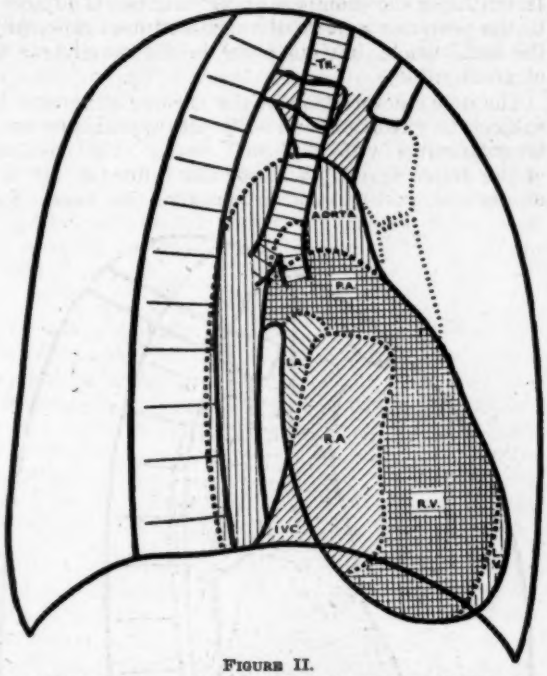

FIGURE II.
Diagrammatic representation of the radiological appearances of the heart from the right, or first, oblique view. (After Parkinson and Bedford.)

In the oblique positions the chambers that produce the edges of the shadow depend on the degree of rotation of the patient, and this should be such that the chamber that is being studied is revealed most favourably. In the right oblique view of the normal subject (Figure II) the upper ventral part of the silhouette is formed by the vascular pedicle, especially the ascending aorta. The remainder of this aspect is formed by the pulmonary artery and the right ventricle, except in the smaller degrees of rotation, when the left ventricle forms part. The dorsal aspect of the silhouette of the heart is formed by the left auricle (the posterior auricle of Parkinson) and by a part of the right auricle below. The shadow of the *inferior vena cava* may be seen in the cardio-hepatic angle. The descending aorta is visible posteriorly.

In the left oblique position (Figure III) the ascending aorta is seen in the upper part of the ventral aspect. The lower part is formed by the right ventricle, except in the lesser degrees of rotation. Cranially the aortic arch extends backwards into the descending aorta.

Above the arch the aortic triangle is completed by the spine and the left subclavian artery. Below the arch the aortic window is seen, and it contains the bifurcation and the left main branch of the pulmonary artery, together with the left bronchus. Behind the aortic window the descending aorta extends downwards to the diaphragm. The dorsal aspect of the heart in this position is formed by the left auricle above and by the left ventricle below. In outlining the chambers and great vessels adjacent to the posterior part of the mediastinum, especially the left auricle, barium paste in the œsophagus is of great value.

The above description of the cardiac silhouette is subject to variation and still the appearance may be compatible with a normal heart. The position of the diaphragm is an important influence. If the diaphragm is high, as in obesity, the heart lies

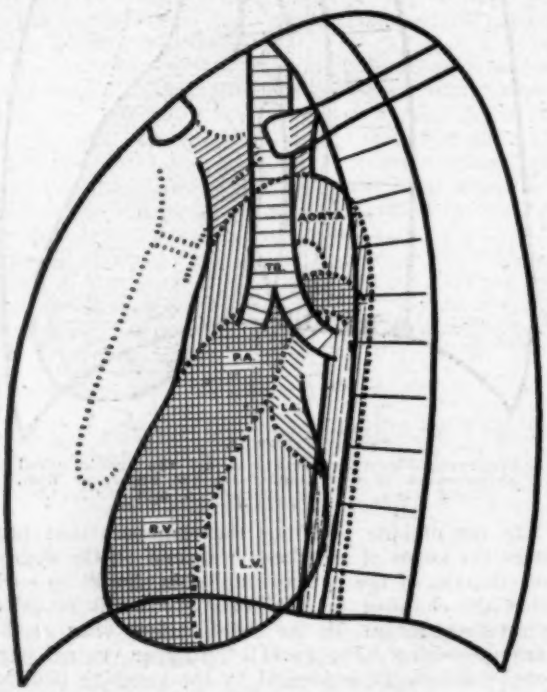

FIGURE III.

Diagrammatic representation of the radiological appearances of the heart from the left, or second, oblique view. (After Parkinson and Bedford.)

more transversely, so that on superficial examination the left ventricle will appear enlarged and the vascular pedicle may be shorter and wider. On the other hand, if the chest is long and narrow and the diaphragm low, the long axis of the heart lies more vertically, the heart appears small and the pulmonary arc may be prominent. There are other difficulties in the interpretation of the silhouette; for example, the heart rate (a heart appears larger when its action is slow than when it is rapid, other things being equal); but with experience these are realized and proper allowance is made.

Radiology of the Heart in Disease.

The silhouette of the heart and great vessels may be altered considerably in disease both by greater prominence of the chambers and great vessels normally taking part in the various aspects and by the appearance of the outline of chambers and great vessels that are not ordinarily present on these borders. A short description of the radiological appearances of several of the commoner abnormalities will be given; it will be realized that all of these appearances are not present in every case of the lesion described.

Mitral Stenosis.

In the anterior position the pulmonary arc and the conus of the right ventricle are prominent in mitral stenosis (see Figure IV). The left auricle may enlarge to the right and appear above and in the upper portion of the right auricular shadow. With aneurysmal dilatation the left auricle may extend almost to the right wall of the thorax. The left ventricle may be enlarged in some cases of mitral stenosis; but this suggests reexamination for an aortic diastolic murmur or for hypertension. The hilar shadows are increased, especially in the more severe grades of stenosis, even without failure, and in auricular fibrillation. Other features that may be noted are smallness of the aortic knuckle and splaying out of the bronchi. In the right oblique position (Figure V) the enlarged left auricle is seen posteriorly; like the pulmonary artery (or left bronchus) it is outlined by barium paste in the œsophagus. The right ventricle, especially the conus, is prominent anteriorly.

Aortic Stenosis.

There is usually moderate enlargement of the left ventricle in pure aortic stenosis. Changes due to old age may be present in the aorta, which then has a "banana" shape in the anterior position. If aortic stenosis is due to a previous rheumatic infection, aortic regurgitation is associated usually; this will be considered under the latter heading.

Aortic Incompetence.

Enlargement of the left ventricle may be visible in both anterior and left oblique positions (see Figures VI and VII). There may be increased pulsation near the lower part of the left ventricle and in the aorta; but care is necessary in the interpretation of pulsations seen with the fluorescent screen. If a previous rheumatic infection is the cause, the appearances of mitral stenosis may be added to those of aortic incompetence. If the lesion is due to syphilis, dilatation of the aorta, especially the ascending portion, may be present, or an aneurysm in any part may be visible. If an aneurysm is beyond the ascending aorta, aortic incompetence may not be present; if the aneurysm is in the descending aorta, the barium-filled œsophagus may be displaced forwards.

Hypertension.

The left ventricle is usually enlarged in hypertension. The aorta may be unfolded so that it

projects to the right of the vascular pedicle and the aortic knuckle is higher and more prominent in the anterior view. The descending aorta may be seen in the left lung field. This appearance may be mistaken for an aneurysm of the aorta. If the patient is rotated into the left oblique position, the unfolded aorta and the enlarged left ventricle will be beautifully displayed. The aortic triangle is small. The window within the uncoiled aorta is large and the bifurcations of the trachea and of the pulmonary artery are visible in this area; the left branch of the pulmonary artery runs across the window. The aorta may be tortuous if atherosclerosis is present with or without hypertension.

Pericardial Effusion.

The silhouette in the presence of a pericardial effusion of moderate size is enlarged and globular and the transverse diameter is increased. The indentations are absent and pulsation is diminished. The vascular pedicle is shortened, because the pericardial cavity extends on the vessels for a short distance. This shortening is seen best in the recumbent posture early; but later it may be visible when the patient is upright.

Aneurysm of the Heart.

A cardiac aneurysm may form after coronary occlusion (see Figure VIII). It presents often as a ledge on the lower part of the left border of the heart in the anterior view. It may be seen in the oblique positions. An aneurysm may be visible more easily if the patient has had a drink of soda-water to distend the stomach.

Patent Ductus Arteriosus.

In patent *ductus arteriosus* the heart may or may not be slightly enlarged. The pulmonary artery is prominent; but the left auricle is not enlarged.

Patent Interauricular Septum.

The silhouette of the heart is large because of enlargement of the right auricle to the right and of the right ventricle, which extends considerably to the left. The right auricle and ventricle, therefore, may form almost the whole of the front of the heart. The left auricle may be enlarged, especially in Lutembacher's disease. There is great enlargement of the trunk and branches of the pulmonary artery, and pulsation is prominent at the hila of the lungs. The aortic knuckle is small or absent. The radiological appearances in this disease are quite characteristic (see Figure IX).

Patent Interventricular Septum.

There may be slight enlargement of the heart and of the pulmonary artery. The left auricle is not enlarged.

Fallot's Tetralogy.

The heart is enlarged to the left, owing to the large right ventricle. The left lower pole is blunt, with two prominences, the upper being formed by the left ventricle and the lower by the right ventricle. This is the *cœur-en-sabot* or wooden-shoe heart. The pulmonary arc is attenuated; but the aortic shadow may be enlarged. The silhouette may resemble that of aortic incompetence; but it can be distinguished, first, by the blunt left lower pole, and secondly, by rotating the patient into the oblique positions, when the enlargement will be found to be of the right ventricle and not of the left.

Coarctation of the Aorta.

The left ventricle may be enlarged if hypertension or aortic regurgitation is present as well as coarctation of the aorta. The ascending aorta may be prominent; but the aortic knuckle may be small or absent in the anterior view. The site of narrowing may be visible in the left oblique position; the degree of constriction varies from none to complete interruption of the aorta. Erosion of the ribs by the enlarged intercostal vessels (Roesler's sign) may be seen in the film, and this is diagnostic of the lesion.

Thyreotoxicosis.

In some patients suffering from thyreotoxicosis the pulmonary artery is enlarged; later, when general enlargement of the heart has occurred, the silhouette is ham-shaped. When congestive failure occurs there is further enlargement of the heart and congestion is observed in the lungs. If a retrosternal goitre is present, it is visible as an opacity which has the shape of a wine-glass, lying above the aorta; the trachea is sometimes narrow at the site.

Emphysema.

In the anterior position the commonest appearance is enlargement and increased density of the pulmonary artery and its branches; this is seen in the hilar region, and it extends into the lungs, especially downwards, so that the appearance has been likened to a moustache. In some cases there is enlargement of the pulmonary arc; but this is not great. In the left oblique position the bifurcation of the pulmonary artery may be seen as a dense shadow, from which the left pulmonary artery arises and runs across the aortic window. The conus of the right ventricle is less often enlarged and, owing to the small increase in size, it is not often demonstrable in the anterior position; but it may be seen in the left oblique position. The conus is the first part of the right ventricle to enlarge, as it is the end of the outflow tract. Enlargement of the body of the right ventricle is observed occasionally; but it is usually slight. It is best seen in the right oblique position, rotation being beyond 45°.

The Value of Radiology in the Diagnosis of Heart Disease.

The foregoing descriptions indicate that the silhouette of the heart and great vessels has a characteristic appearance in many diseases. Radiology reveals not only the position and size of the heart as a whole, but also the size of the individual chambers and great vessels. The study of the silhouette discloses the external outline of the

chambers of the heart during life. In fact, the anatomy of the heart may be less distorted than on *post mortem* examination, when the chambers are no longer distended by the circulating blood. Hence radiology aids in establishing an accurate anatomical diagnosis of the various lesions. On the other hand, it must be realized that in this world of shadows illusions can and do occur; but this difficulty can be overcome with care and experience.

Examination with the fluorescent screen may disclose unsuspected disease in the heart or in surrounding structures; indeed this may be the only means of satisfactorily demonstrating certain diseases of the heart and great vessels during life. But a normal silhouette, like a normal electrocardiogram, does not necessarily mean an absence of heart disease. If the patient is suffering from atherosclerosis of the coronary arteries, without present or previous hypertension, the shadow of the heart is usually within normal limits, although the outline of the aorta sometimes provides indirect evidence of disease. Again, in constrictive pericarditis the heart may not be enlarged. Therefore it is necessary to take a careful history and to use clinical and perhaps electrocardiographic methods in addition to the radiological examination of patients suspected of heart disease. Radiology is not a substitute for clinical examination; it is an additional application of our best-trained sense—that of vision.

In most cases radiological examination serves as an accurate means of verifying the clinical findings. After the presystolic murmur enlargement of the left auricle in the right oblique position is the best evidence of mitral stenosis. If the presystolic murmur has disappeared, as, for example, in auricular fibrillation, when separation from goitre may be difficult, or if there is uncertainty whether a presystolic murmur or a split first sound is heard, the presence of definite enlargement of the left auricle will settle the diagnosis. It is interesting to observe the displacement of the barium-filled œsophagus by the large left auricle, and yet dysphagia is seldom a complaint of patients suffering from mitral stenosis.

Enlargement of the left ventricle is seen in the anterior and left oblique positions. Hypertension, past or present, is the commonest cause of this enlargement, and in this disease the aorta may be unfolded. In the absence of a raised blood pressure an aortic diastolic murmur may have been overlooked. Occasionally aortic stenosis is the cause of an enlarged left ventricle; the characteristic thrill and murmur will enable recognition of this lesion.

The study of congenital heart disease has been clarified considerably by radiological examination and its correlation with the clinical and also with the *post mortem* findings in fatal cases. It is true that clinical and radiological examinations do not permit an accurate anatomical diagnosis in every case of congenital *morbus cordis*, particularly in those with multiple lesions. Nevertheless fluoroscopy supplies accurate information of the size of the various chambers and great vessels. The size of the pulmonary artery, demonstrable only by X rays during life, is of great importance in congenital heart disease. The pulmonary artery is enlarged in patent *ductus arteriosus*, patent interauricular septum and patent interventricular septum; the artery is small in Fallot's tetralogy. The size of the right ventricle is also important. Although enlargement of this chamber may be overlooked by ordinary clinical methods, the oblique positions enable its recognition under the screen. Much information is obtained, therefore, by radiological examination. By correlation with the thrills and murmurs found on clinical examination an accurate diagnosis of many congenital heart lesions can be made.

Diseases of the pericardium may be demonstrated by radiology; but small effusions are difficult to detect. The silhouette of a moderate pericardial effusion may be globular, with loss of indentations and shortening of the vascular pedicle, especially on assumption of the recumbent posture; but sometimes it is not easy to distinguish the shadow of an effusion from that due to general enlargement of the heart. Chronic mediastino-pericarditis is seldom the cause of great enlargement of the heart, which in this disease may be due to an accompanying valve lesion, especially aortic incompetence. Indeed, in some cases of chronic pericarditis, the size of the heart may be unaltered and the pulsations may be reduced, owing to a thick constricting pericardial covering, which may become calcified and radio-opaque. Calcification in the heart and great vessels is demonstrable by X rays in other conditions; it is seen occasionally in the valves of the heart, in aneurysms and atheroma of the aorta and rarely in the coronary arteries.

In emphysema, dyspnœa is frequent, the veins of the neck are often distended and cyanosis may be observed. In this disease it is often difficult to decide the relative amounts in which the clinical manifestations are due to disease of the lungs and to disease of the heart. To diagnose heart disease it is not necessary to wait until failure has become manifest by the presence of an enlarged liver and of œdema of the inferior extremities. This stage is seldom reached, because of the effect of emphysema alone; but if it is, the prognosis is bad. Cardiac involvement in emphysema can be diagnosed much earlier on radiological examination by the features previously described. But emphysema is often complicated by some other cardio-vascular disease, particularly hypertension, and this is more likely to produce cardiac failure. Of course the radiological appearances of this complication would be superimposed on any that might be present because of emphysema.

Radiology and the Clinical Examination of the Heart.

Radiology has demonstrated the many fallacies of percussion of the heart, and this method of examination is omitted by many cardiologists. Percussion can give at its best inaccurate information of

the size of the heart in a coronal plane. The heart has depth, which cannot be estimated by percussion. The size of the left auricle cannot be determined by percussion unless it is greatly enlarged; but radiology in the oblique positions can detect much smaller degrees of enlargement. Percussion of the lung areas is, however, of value, as it may help to disclose the presence of such conditions as hydrothorax, intrathoracic neoplasm or aneurysm of the aorta; these are demonstrable more easily and clearly by X ray examination but this is not always available.

The position of the apex beat has assumed great importance in the examination of the heart. The apex beat is the lowermost and outermost point at which a forward lift is imparted to the palpating finger. This definition is important, particularly if the impulse is diffuse, as in tachycardia. In most instances of slight or moderate enlargement of the heart the left border, as seen by fluoroscopy, corresponds closely with the apex beat. In gross enlargement of the heart the apex beat is beyond the left border of the silhouette. This discrepancy is due to the transmission of the impulse to the left rather than anteriorly, as in the lesser grades of enlargement.

There are many difficulties in the use of the position of the apex beat as a guide to the size of the heart. In obesity or emphysema the apex beat may be impalpable. In such cases radiological examination is the only means of estimating the size of the heart during life. Even with radiology the definition of the left lower pole may present some difficulty in a fat person, and especially if there is a triangular mass of fat in the region of the left lower pole. If the impulse is palpable it may be displaced by factors outside the heart. The apex beat of a normal child may be in or beyond the nipple line, and this displacement has been shown by radiology to be caused commonly by slight scoliosis. Other chest deformities, pleural effusion and pulmonary fibrosis may cause displacement of the apex beat; X ray examination will reveal these extrinsic factors and disclose the true size of the heart.

One or more chambers of the heart may be enlarged and yet the position of the apex beat remain within normal limits. In many cases of mitral stenosis there is little displacement of the apex beat; but the oblique views on fluoroscopy show enlargement of the left auricle and the right ventricle. In the absence of extrinsic factors the position of the apex beat gives information of the size of the left ventricle, but almost neglects the other chambers of the heart.

During examination with the fluorescent screen it is interesting to palpate the impulse of a slowly beating heart. The impulse produced by the heart is palpable before systole is observed on the screen. The explanation is that the impulse is produced at the phase of isometric contraction, when the pressure is rising in the ventricles and before the semilunar valves have opened, whereas radiological systole is the period of ejection of blood from the ventricles to the great arteries. The stethoscope, too, may be applied to the chest while the heart is examined under the screen. The first heart sound is heard before radiological systole, during the phase of isometric contraction. The second sound is heard during radiological systole after the ejection of blood to the arteries but before the ventricles have filled with blood from the auricles.

Enlargement of a heart is usually present before the occurrence of decompensation. It is well known that in cardiac failure the apex beat may move further to the left, and this is usually believed to be due to additional enlargement of the heart. Radiology has shown that, excepting the right auricle and the *superior vena cava*, the chambers of the failing heart do not commonly increase in size. Elevation of the diaphragm is a more important factor in the movement of the apex beat, and this is produced especially by the enlarged liver, but also by tympanites and ascites. The heart lies more transversely, hence the apex beat is displaced to the left. The frequent presence of a right hydrothorax may play a part; but a hydrothorax causes much less displacement of the heart than does an inflammatory effusion, and a right hydrothorax may be countered by one on the left side. Hydropericardium may play a part in the enlarged silhouette of the failing heart.

The radiological examination of the lungs is of value in heart disease. In left ventricular failure the earliest sign of pulmonary engorgement is seen in the prominence of the hila of the lungs, and later crepitations are present at the bases. With successful treatment the hilar congestion gradually diminishes and finally disappears. Repeated screening will help in assessing the result of treatment. If there has been chronic passive hyperæmia, as in mitral stenosis, the hilar markings may remain prominent, and there may be miliary opacities in the lung fields. Care must be taken to differentiate this appearance from that of miliary tuberculosis or carcinoma.

Summary.

1. The radiological appearances of the heart are described in health and in some diseases.

2. The value of radiology in the diagnosis of heart disease is indicated. Some diseases may be diagnosed by radiology alone, others by clinical methods alone; but most diseases of the heart are demonstrable by combined clinical and radiological examination.

3. Certain physical signs are reviewed in the light of the radiological examination of the heart.

Acknowledgement.

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CYSTIC TUMOURS OF THE THIRD VENTRICLE.

By LEONARD C. E. LINDON, M.S., F.R.C.S.,
Honorary Surgeon and Surgeon in Charge of the Neuro-Surgical Clinic, Adelaide Hospital, Adelaide.

EARLY in 1930 the writer had the privilege of witnessing the successful removal of a tumour of the third ventricle by Professor Harvey Cushing, by the method to be described later; and the impression of this surgical performance remains as one of the most perfect he has ever seen. The diagnosis was made entirely by clinical acumen, without resort to ventriculography; and Professor Cushing modestly ascribed the successful diagnosis to his clinical "hunch". The writer's interest in these benign tumours was thereby greatly stimulated; but they are a rare condition. On the other hand, the assistance of ventriculography has increased the possibility of recognition of these tumours, even though the early signs produced by them may be extremely equivocal. A group of symptoms has been described as the syndrome of the ball-valve tumour, whether the tumour is in the third or in the lateral ventricle. These symptoms consist of periodic and paroxysmal attacks of severe frontal and occipital headache, with vomiting and giddiness, the attacks lasting a few minutes to several hours, and being followed by complete relief. In the writer's small experience a presumptive diagnosis of ball-valve tumour has been made on several occasions; but only once has the diagnosis been proved correct ultimately.

In a total of 148 verified cerebral tumours or cysts, three cases of colloid cystic tumour of the third ventricle have occurred.

Reports of Cases.

CASE I.—Mrs. A.W., aged thirty-six years, was referred to me in consultation by Dr. de Crespigny in 1931. She gave the classical history of attacks of very severe frontal and occipital headaches, sudden in onset, accompanied by profuse vomiting, and ceasing as suddenly as they began. She noticed they were often induced by straining, and produced the feeling that she was going to lose her balance and fall forwards. The only definite neurological findings were those of great bilateral papillœdema and general unsteadiness. A presumptive diagnosis of a ball-valve tumour, probably in the third ventricle, was made, and this was confirmed by ventriculography, which revealed obstruction to both foramina of Munro. However, operation was eventually performed in another clinic, on a diagnosis of cerebellar tumour. Death occurred during this operation, and at autopsy a typical grape-like colloid cyst in the anterior end of the third ventricle was found, which was occluding both foramina of Munro, and which confirmed the ventriculographic interpretation. The specimen has since been lost, and no record remains of its histology.

CASE II.—A male patient, J.M., of unknown age, was transferred to my clinic late at night in August, 1937, in an unconscious condition. He had been admitted to the hospital in a very drowsy condition, and very little history could be obtained from his relatives. Bilateral papillœdema indicated a great increase of intracranial pressure; and as his condition was very grave, it was decided forthwith to try ventricular estimation, believing he might have a cerebellar tumour. This was done, and both lateral ventricles were found to be greatly dilated, each containing over 80 cubic centimetres of fluid. Unfortunately X ray examination was not available, and therefore no air was introduced into the ventricles. Improvement in his condition was apparent by the end of the operation, and next morning he was conscious, but still unable to give much reliable history. But at midday he suddenly became unconscious again, and died soon after. Autopsy revealed two unexpected conditions: first, a *glioblastoma multiforme* as large as a golf ball in the left post-parietal cortex, and secondly, a colloid cyst of the anterior end of the third ventricle, two centimetres in diameter, completely occluding both the foramina of Munro, causing great dilatation of the lateral ventricles. Death evidently resulted from sudden impaction, with pressure, of the cyst in the anterior end of the third ventricle.

Microscopic examination revealed that it consisted of a number of spaces lined by a columnar epithelium containing colloid material, the spaces being separated by a connective tissue framework; and it was considered to be a typical cyst of the choroid plexus of the third ventricle.

The third case will be described in detail, to illustrate Cushing's method of transventricular approach to such a tumour.

CASE III.—Mr. A.Y., aged fifty-two years, was referred to me by Dr. Munday and Dr. Tostevin. Having previously enjoyed good health, on December 28, 1937, he was seized with severe bitemporal headache and felt sick and very giddy and unsteady. The headache lasted twenty-four hours, then passed off, and has not recurred. But on December 30, 1937, he noticed that his vision was failing and that he could see very little with his left eye. He was referred to Dr. Tostevin, who found early bilateral papillœdema, but the swelling could not be accurately measured, owing to the presence of very extensive retinal hæmorrhages in both eyes. In the left eye the disk was almost entirely obscured by blood, and vision was less than $^6/_{60}$, while in the right it was reduced to $^6/_{12}$. The peripheral fields were normal, but there were many central scotomata.

When seen by me, on January 10, 1938, the patient still complained only of his visual defect and denied any further headaches, though he admitted that his head felt "funny". Apart from his ocular condition I could detect no neurological abnormality or asymmetry. His balance and his motor and sensory functions were all perfect, except for some deafness and tinnitus in the right ear, which had been present ever since a head injury received twenty-five years ago. On January 2 he slept for seventeen hours; otherwise there had been no hypersomnia.

The only conclusion at which I could arrive was that a state of rapid increase of intracranial pressure existed, and that the condition of his eyes demanded urgent relief. The pressure of the cerebro-spinal fluid (taken with some apprehension) was 350 millimetres of water; globulin and

ILLUSTRATIONS TO THE ARTICLE BY DR. L. E. ROTHSTADT.

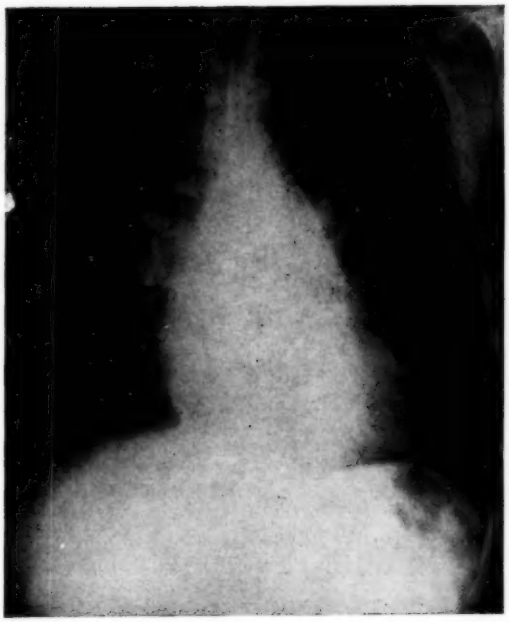

FIGURE IV.
Mitral stenosis, anterior view. The patient was a man, aged thirty-two years. The left auricle is enlarged above and behind the right auricle. The pulmonary arc is filled out and fuses with the small aortic knuckle.

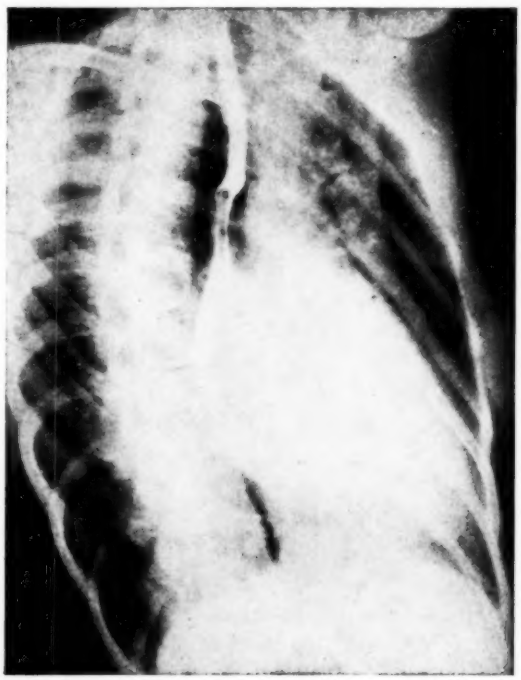

FIGURE V.
Mitral stenosis: right (first) oblique view, with barium paste in the œsophagus. The patient was a female, aged thirty-five years. The enlarged left auricle has displaced the barium-filled œsophagus backwards and the combined aortic and pulmonary artery (left bronchus) impression is visible above this. The enlarged right ventricle is seen anteriorly.

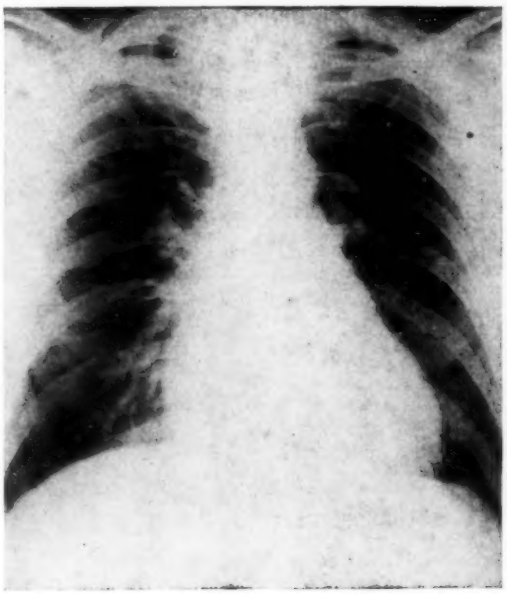

FIGURE VI.
Aortic incompetence and mitral stenosis: anterior view. The patient was a man, aged thirty-five years. The left ventricle is enlarged and the pulmonary arc is filled out. The aortic knuckle is larger than in uncomplicated mitral stenosis. The left auricle is enlarged to the right.

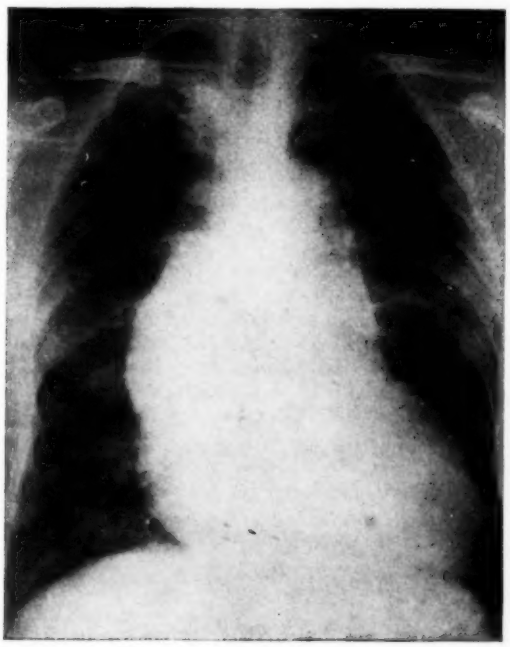

FIGURE VII.
Aortic incompetence and aneurysm of the ascending aorta: anterior view. The patient was a man, aged sixty-two years. The left ventricle is enlarged. The aneurysm is seen in the ascending aorta; elsewhere there is widening and increased density of the aortic shadow.

ILLUSTRATIONS TO THE ARTICLE BY DR. L. E. ROTHSTADT.

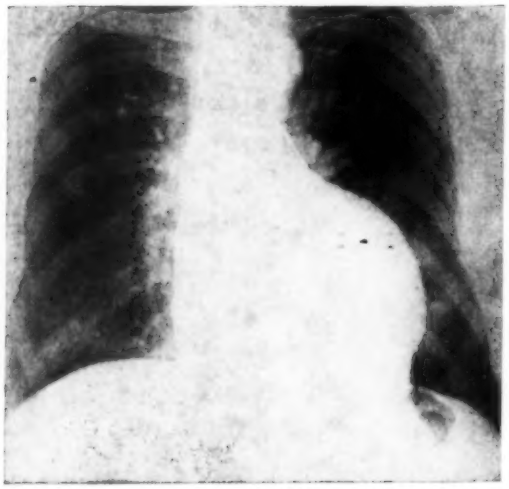

FIGURE VIII

Aneurysm of the heart following coronary occlusion three years previously: anterior view. The patient was a man, aged seventy years. The aneurysm is visible on the left border of the heart. The aorta shows the senile change of atherosclerosis.

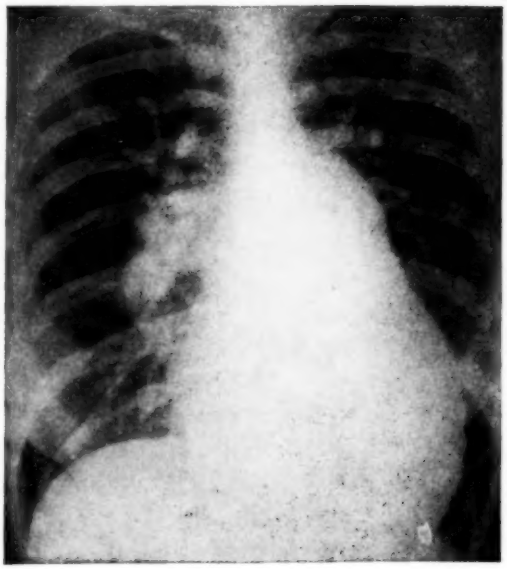

FIGURE IX.

Congenital heart disease (patent interauricular septum): anterior view. The patient was a woman, aged thirty-five years. The enlarged right auricle is seen on the right border, and the enlarged right ventricle extends to the left. The aorta is scarcely visible; but the pulmonary artery is greatly enlarged and the vessels at the hila of the lungs are prominent.

ILLUSTRATIONS TO THE ARTICLE BY DR. LEONARD C. E. LINDON.

FIGURE I.

Right lateral ventriculogram, showing considerable dilatation of the ventricle, with the passage of only a very minute quantity of air into the third ventricle. The *septum lucidum* can be seen bulging towards the right side, that is, the side in which pressure has already been reduced.

FIGURE II.

Combined ventriculogram, showing an even greater dilatation of the left lateral ventricle and still no passage of air into the third ventricle. Note that the *septum lucidum* still bulges well over to the right side, towards the side of original tapping. This appearance does not arise if any perforations of the *septum lucidum* are present.

protein were increased up to double the normal value, cells were not increased, and the fluid failed to respond to the Wassermann test. Ventriculography was decided upon as the next step, after repeated neurological examinations had failed to add any information.

On January 17, 1938, ventriculography was carried out under local anæsthesia with "Novocain". Fifty cubic centimetres of fluid in the right lateral ventricle were replaced by air, and the subsequent films revealed a much dilated ventricle, from which practically no air had passed either to the third or to the left lateral ventricle (Figure I). It was also noticed that the *septum lucidum* was bulging well over to the right side. Then 60 cubic centimetres of fluid in the left ventricle were replaced by air. Again no air passed into the third ventricle, and the intact *septum lucidum* still bulged towards the side first tapped (Figure II). Dandy, in his monograph, describes these ventriculographic findings as being certain proof of the presence of a tumour of the anterior end of the third ventricle.

Two hours later, under "Novocain" anæsthesia, a large right frontal osteoplastic flap was turned down. Tension of the dura was relieved by tapping of the anterior horn of the right ventricle, which was reached at a depth of five centimetres.

An incision four centimetres long was made in the hind end of the middle frontal convolution, sloping forwards and outwards, and an unexpectedly bloodless approach was made into the dilated right ventricle, the ventricle being entered immediately opposite the foramen of Munro, which is easily recognized by following down the small vessels which run in the *septum lucidum*, converging in the foramen. Tension was further reduced by perforation of the bulging *septum lucidum*, fluid and air being liberated. The foramen of Munro could now be well seen, and it was observed to be blocked by a bluish-green tumour. The foramen was enlarged slightly by an incision in its anterior wall. The wall of the tumour was then punctured, some viscid, turbid fluid being allowed to escape. The collapsed cyst was then drawn through the foramen into the lateral ventricle, when its vascular attachment to the choroid plexus of the third ventricle was coagulated and divided. Hæmostasis being satisfactory, the ventricles were carefully inspected for pieces of blood clot, the walls of the brain incision were allowed to come together and the wound was closed.

During the manipulation of the cyst in the foramen of Munro the patient lost consciousness for about twenty minutes; but he was speaking and drinking during the closure of the wound. The whole operation lasted nearly four hours, during which he exhibited the most praiseworthy fortitude. The blood pressure chart, kept by Dr. Lamphee, illustrates well the value of local anæsthesia in intracranial surgery, given a patient who is mentally clear and sufficiently stoical. The patient's smooth convalescence and ultimate recovery were very largely due to this fact.

Convalescence worried the surgeon much more than the patient, as I had had no previous experience with this operation on the third ventricle. During the first twenty-four hours the patient's temperature once reached 37·8° C. (100° F.). From that day onwards it was never above normal. The problem was to decide how much or how little to do. Lumbar puncture was performed on the second, fifth and eighth days, the pressures being 300, 250 and 120 millimetres of water respectively. On the first and second occasions, as the fluid was very yellow, 30 cubic centimetres of fluid were withdrawn (I think Cushing used to advocate post-operative withdrawal of fluid so long as the fluid was xanthochromic) and perhaps this contributed to the peaceful apyrexial convalescence. During the first two days the patient occasionally spoke irrationally, but apart from that his convalescence was perfectly normal. Although he was so well, it was decided to be very cautious; he was kept in bed sixteen days and was not allowed home till the twenty-sixth day. He was shown at a meeting of the British Medical Association on February 24, 1938, when his vision had improved to $^6/_9$ in the right eye and $^6/_{24}$ in the left. The hæmorrhages in the left eye had not yet been entirely absorbed. Otherwise he appears to be none the worse for his ordeal, and his prognosis should be excellent.

Dr. Thiersch describes the cyst wall as being composed of connective tissue lined by a single layer of tall cylindrical epithelial cells, and considers it undoubtedly a true cyst of the chorioid plexus, and not ependymal or paraphyseal in origin.

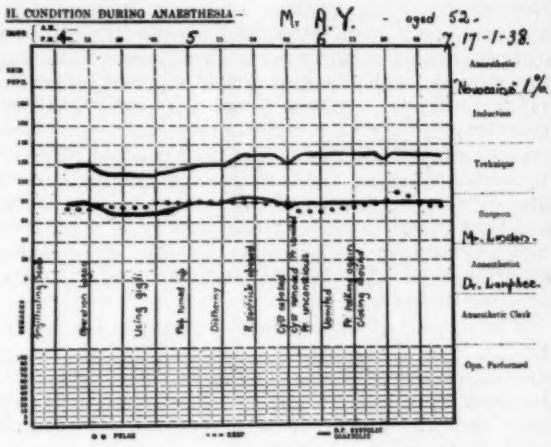

FIGURE III.
Copy of anæsthetic chart kept by Dr. A. Lamphee, illustrating the satisfactory circulatory condition maintained throughout the operation.

Discussion.

At the annual meeting of the British Medical Association, held at Belfast, Walshe read a paper in which he criticized the tendency to resort too early to ventriculographic methods, to the exclusion of thorough clinical observation. In answer to this statement, in the subsequent discussion, Norman Dott pointed out that no neurological surgeon worth his salt would adopt these methods unless clinical observation could get him no further in diagnosis; and that judicious ventriculography would frequently achieve localization before the patient had been too adversely affected by the effect of prolonged cerebral œdema.

This is particularly true in a case such as the one described. Rehbock (*Archives of Pathology*, Volume XXI, 1936, page 524) has collected fifty-six cases of colloid cyst of the third ventricle. Many were found only at autopsy, while in most of those in which a preoperative diagnosis had been made, symptoms of grave disturbance of function had been present for months or years, greatly militating against functional recovery. In fact, even as recently as 1936 he was able to find records of only nine recoveries. This must surely be an underestimation; but it seems certain that these ball-valve tumours cannot be diagnosed early without resort to ventriculography at an early stage.

Apart from the importance of early diagnosis in preventing irreparable damage to brain tissue, there is another fact to be emphasized. Many of these patients have died suddenly from impaction of the colloid cyst, as in the second case reported in this paper. These cystic tumours must be very liable

to sudden changes in size and tension, and tight impaction may easily result; and the presence of the vital hypothalamic nuclei in the walls and floor of the third ventricle must make a sudden fatality a constant possibility in these cases. The diagnosis can be suspected on the "ball-valve" history and on third-ventricle symptoms, such as hypersomnia, polyuria, polydipsia *et cetera*. But after all, any of these symptoms may occur in any lesion causing interference with blood and fluid circulation in the third ventricle. Actual proof can come only by ventriculography, for few of us will ever have enough experience to develop that clinical "hunch" to which Cushing referred. In my experience a history very suggestive of the "ball-valve" syndrome has been found in such diverse lesions as a parietal meningioma, an astrocytoma in the wall of the anterior horn of a lateral ventricle, and cisternal arachnoiditis.

The origin of these colloid cysts is uncertain. Leitlin and Lichtenstein (*Archives of Neurology and Psychiatry*, Volume XXXVIII, 1937, page 268), in describing two cases discovered *post mortem*, have reviewed the opinions of various pathologists as to their origin; they have been regarded by some as true cysts of the chorioid plexus, by others as of ependymal origin. These authors bring forward a convincing argument for their origin from a remnant of the paraphysis.

Summary.

1. Three cases of colloid cyst of the third ventricle are described. One patient survived operation.
2. The chief physical sign in this case was the presence of extensive retinal hæmorrhages, out of all proportion to the degree of papillœdema.
3. Some problems in diagnosis and the technique of removal of the cyst are discussed.

ETHER ANÆSTHESIA AND ANALGESIA IN MIDWIFERY.[1]

By THOMAS H. SMALL, M.B., Ch.M., M.C.O.G.,
Honorary Assistant Surgeon, Royal Hospital for Women, Paddington; Tutor in Obstetrics, University of Sydney.

THE relief of pain during labour has engaged the attention of the medical profession from time to time, for many years, and a multitude of appliances and preparations and of methods of using them has resulted.

I have always had great sympathy for women in labour, and lately, like most general practitioners, I have tried many drugs advocated for the relief of their pains. I am certain that much psychic shock is experienced by those patients who lie white and quiet after an exhausting and painful labour, and who vow that they will never have another baby. Of course, time heals the mental wound, and they are soon happy with their babies; but all the same they have had an experience they are not likely to forget and not anxious to repeat. A marked contrast, both in appearance and outlook, exists between these women and those who have had something to take the agony and terror out of their labour.

Of all the drugs tried, the barbiturates seemed the most efficient; but they have the disadvantages of unreliability, and occasional unpleasant after-effects, such as severe headache, dizziness and faulty memory for varing periods. Moreover, the behaviour of many patients under their influence (too often not seen by the doctor) frequently requires the attendance of a special nurse, who may be quite exhausted after a few hours with an excitable or difficult patient.

Methods requiring frequent attendances of the obstetrician to control dosage have never appealed to me, because a general practitioner can rarely spare the necessary time. Such methods as the rectal administration of "Avertin", ether, or paraldehyde, and narcosis induced by the frequent injections of morphine and scopolamine, I have not tried for this reason.

A pain recurring intermittently should not require a sedative acting continuously with the patient in a semi-comatose condition; a substance acting very rapidly and for a short time seems more logical.

Nitrous oxide and oxygen, self-administered intermittently, are ideal under favourable conditions. But in general practice they have disadvantages, notably the bulk and weight of the apparatus and the cost of the gases, which is between one and two guineas per case. Moreover, one needs to be a trained gas anæsthetist in order fully to exploit the advantages of gas and oxygen, without recourse to chloroform or ether, to get sufficient relaxation for delivery in a difficult case, for forceps, or for perineorrhaphy.

Nitrous oxide and air, with Minnitt's apparatus, relieves the pains; but the ratio cannot be varied, nor can it be used for anæsthesia. The cost of gas is about eight shillings for each labour. The apparatus is in a portable case, measuring twenty-two inches by thirteen inches by seven and a half inches, and weighs thirty-seven pounds. But other apparatus for surgical anæsthesia must be carried as well.

Cyanosis may occur with self-administered gas and air or gas and oxygen; and if chloroform is used for anæsthesia following on this, an alarming syncope may result.

H. Buschbeck[1] condemned chloroform on account of the risk of sudden syncope and the delayed poisoning in toxæmic cases, and stated that it had not been used in the Wurzburg Clinic, Germany, since 1923. For general practice he advocated open ether, and this is the method now used as a routine measure in that clinic; gas proved to be too costly and the apparatus too heavy. There, ether is given intermittently with each pain, and is used only for the delivery of the head and shoulders.

[1] Read at the fifth session of the Australasian Medical Congress (British Medical Association), August, 1937.

The tendency there is against the early use of analgesia; and the method uses about 11·25 to 30 cubic centimetres (three to eight drachms) of ether for each case. Buschbeck observed a large series of cases (2,166). He stated also that ether did not weaken the contractions or affect the child, and that toxic and other ill-effects were absent.

It seemed to me that relief could reasonably be given earlier. Observation has given me the impression that the first-stage pains, especially towards the end, can be very severe, and that patients complain more of these than of the second-stage pains, with the exception of those during the distension of the perineum and birth of the head, which causes a different type of pain.

Aleck W. Bourne and J. H. Burns[2] found that ether and chloroform as "anæsthetics" diminished the force and frequency of uterine contractions during labour; but they specially stated that this did not apply to the light anæsthesia used to relieve pains in labour. They advocated chloroform and ether as being entirely suitable for light and surgical anæsthesia in midwifery. They said that in Queen Charlotte's Hospital, in a series of 562 cases, there was no increase in the forceps rate, nor in the duration of labour, nor in the incidence of *post partum* hæmorrhage, and no case of chest complication was noted. The infants were unaffected.

Miss K. Lloyd Williams[4] thinks that ether is comparatively slow in its action, and that by the time analgesia is obtained the patient is usually unconscious and therefore unable to cooperate. This means that analgesia does not occur till anæsthesia is produced. My experience does not coincide with this; I believe that analgesia is a definite stage, without loss of consciousness, which precedes the first stage of anæsthesia.

Analgesia means insensibility to pain, and may be relative; anæsthesia means a state of insensibility to all sensation, and therefore loss of consciousness, when used in reference to general, as distinguished from local anæsthetics. Miss Williams states that "in the light stages of ether anæsthesia the patient often becomes excitable and difficult to control, and it is not easy to vary the depth of anæsthesia, as it is needed". I have found that the first part of this is correct, but that the difficulty can be overcome in the great majority of cases by allowing the patient, to a certain extent, to control the dose herself, and by producing analgesia instead of anæsthesia. This can be done with the apparatus I shall shortly describe, and with various other types of apparatus as well.

It is generally conceded that ether is the easiest of all anæsthetics to use. It is the simplest and most flexible in its administration; it has a wide safety margin, and gives adequate muscular relaxation. It is low in cost and easily transported, and every doctor can give ether with safety. It has the disadvantage of causing some nausea or vomiting in a number of cases, and it is inflammable. The disadvantages are more than offset by its advantages. Chloroform is fifty-one times and ethyl chloride seventeen times more depressant to the heart than ether. On these grounds there is much to justify the use of ether in obstetrics instead of chloroform in the vast majority of cases.

With these ideas in mind, I set out to devise a suitable apparatus for self-administration of ether, which could be used by the patient for some hours before the presence of the doctor was actually needed. I tried on myself gas and oxygen, gas and air, ether, chloroform and ethyl chloride, producing analgesia each time, and I came to the conclusion that ether had a definite analgesic action before producing anæsthesia, and that once some ether was in the body, this effect could be produced very rapidly.

The Apparatus.

I used for ether, in these experiments, a Clover's inhaler, and from it evolved this apparatus, by separating the face-piece from the tank and introducing a different control arrangement to vary the proportion of etherized air. The total cubic capacity of the whole circuit was fixed at 500 cubic centimetres, this being the average quantity of tidal air, and the diameter of the air passages was fixed at 1·875 cubic centimetres (three-quarters of an inch) after trial, as this allowed easy breathing. Thus every deep breath would about empty the circuit and take all the available ether vapour for full anæsthesia.

A one-way circuit was used to keep the main portion of the apparatus uncontaminated by expired air, this being brought about by valves suitably placed, opening with inhalation and closing by gravity with exhalation. The valves remain closed while the apparatus is not in use, so that there is no escape of ether into the room, and no ether is exposed to a naked flame such as a lamp or a fire. An outlet valve is provided near the face-piece to void exhaled gases to the atmosphere. A flexible, non-kinking tube connects the tank to the face-piece and outlet valve, which are detachable and boilable. Provision is made for inhaling the ether through a layer of gauze moistened with any suitable perfume, such as eau-de-Cologne, to mask the odour. Cold weather makes full anæsthesia slow and difficult to obtain in some patients, so the vaporizing surface of the ether is more than doubled by wicks placed in metal frames inside the tanks. With these, full anæsthesia for obstetric operations can be obtained as well as analgesia in the earlier stages.

There is considerable variation in the dose of ether required to produce analgesia and anæsthesia; so that in using this apparatus the main thing is to set the ratio so that the patient expresses herself as satisfied. This ratio may vary from 1/16 to 1/2 according to individual susceptibility and to the type of breathing. Patients who take good deep breaths get relief on low ratios, and those who tend to sniff at it rather than inhale deeply require a higher ratio.

I always give the women a lesson in how to use the apparatus in the surgery, so that they are able to get the full benefit when the time comes. I begin with two or three breaths at the effective ratio and later increase the number of breaths or the ratio, or both, till relief is satisfactory.

The gases from this apparatus have been collected over water from the outlet valve by means of a tube and tested for inflammability. Up to a ratio of 7/16 they do not take fire; but over this ratio they burn slowly but do not explode. Therefore, the use of this apparatus for analgesia under conditions of general practice is quite safe.

When full anæsthesia is being used the gases collected at the outlet valve will take fire; but as there is considerable dilution in the atmosphere of a room with ordinary ventilation there is very little risk in using ether this way. Nevertheless, I feel that all precautions should be taken in these circumstances. There is certainly much less risk than occurs with the use of an open mask.

A. W. Bourne and J. H. Burns[2] stated that in the first stage of labour the effect of ether anæsthesia was to produce at once a diminution in the force and frequency of the uterine contractions, and when the "anæsthetic" was discontinued they rapidly resumed their previous form. They did not think there was a direct action on the uterus as the effect was too rapid. Bourne and Burns stated that it was most probably due to sympathetic stimulation, which during labour is inhibitory, just as emotion arrests labour and an intravenous injection of adrenaline[3] causes prompt cessation of pains. They concluded that the relief of pain in labour by a few breaths of chloroform or ether was not due only to the anæsthetic action, but at least as much to a diminution in the force of uterine contractions. This applies presumably to analgesia was well.

Whatever the mode of action, the effect of ether is undoubtedly to give considerable, and in some cases total, relief from pain, without causing harm to the mother or child or interfering with the progress of the labour. There is remarkably little nausea or vomiting.

There is no reason why ether analgesia should not be obtained with an ordinary open mask and a drop bottle; though with a method of self-administration the patient knows when to cease inhaling the ether and the attendance of an anæsthetist or nurse all the time is not necessary.

Discussion.

By means of this apparatus I was able to observe the effect of ether as an analgesic in 200 cases at the Royal Hospital for Women, Paddington. My colleagues kindly allowed me to try it on their patients. The results can be discussed under various headings.

Parity.

There were 98 *multiparæ* and 102 *primiparæ*, the largest number of previous children having been nine.

Period of Gestation.

In one case the pregnancy continued for three weeks beyond full term, and labour was induced with quinine and castor oil. In 183 cases labour occurred at term, in fourteen at eight months, and in one each at seven and six months.

Coexisting Pathological States.

There were 31 cases of coexisting pathological states. There were two cases of preeclamptic toxæmia, one of which developed into *post partum* eclampsia. The patient had three convulsions shortly after delivery; both mother and child survived. Twenty-two of the patients had albuminuria, the albumin varying from a "cloud" to "half albumin". There were two cases of influenza complicating labour, and one each of pyelitis, subacute infective arthritis, saphenous thrombosis, treatment-resistant syphilis and pyrexia of unknown origin. These patients (thirty-one in number) did not appear to be adversely affected by ether, although in one case preeclamptic toxæmia became *post partum* eclampsia. The coughs of the influenza patients were not made worse.

Duration of Labour.

The longest labour lasted 50·8 hours, and the shortest 1·5 hours, the average duration of labour being 11·6 hours. The first stage varied in duration from 49·6 hours to 1·0 hour, the average being 9·7 hours. The second stage averaged 1·5 hours in duration, the longest being 5·5 hours, and the shortest 5 minutes. The third stage varied from 1·5 hours to 5 minutes, the average being 0·4 hour.

Duration of Analgesia.

The longest total duration of analgesia was 17 hours, and the shortest 0·1 hour, the average being 2·3 hours. In the first stage the longest period was 14 hours, and the shortest 0·1 hour, the average being 1·2 hours. The second stage averaged 1·1 hours, the longest period being 5·5 hours, and the shortest 0·1 hour.

Progress of Labour.

The progress of labour was unaffected in 184 cases and delayed in 16 cases. The causes of delayed labour were the following: primary inertia in one case, persistent occipito-posterior presentation in three cases, narrow outlet in four cases, post-maturity in one case, delayed second stage and maternal distress in one case, and use of ether or overdosage of ether in six cases.

In these sixteen cases of delayed labour, two patients were *multiparæ* and fourteen were *primiparæ*. Forceps delivery was necessary in ten cases on account of delay. Overdosage occurred in six cases. One *primipara* was noted as being five hours in the second stage. One *multipara* was noted as being 4·7 hours in the second stage. One *multipara* was noted as being 4·0 hours in the second stage. Three *primiparæ* seemed to be "slowed up" by ether, according to the notes of the sister in charge of the labour ward.

Thus in six cases out of 200 delay in the second stage may have been due to ether, the longest stage being five hours in the case of a *primipara*, if the time of commencement of the second stage was accurately noted. This patient was overdosed, having only a hazy memory of the whole labour. I think that overdosage will slow up the labour, but not to any harmful extent.

Ill Effects on the Mother.

The following ill effects on the mother were noted. Excitement occurred in six cases, slight vomiting in 17 cases, in some before the administration of ether was begun. The patient was uncontrollable in three cases, noisy in two cases. Nausea occurred in four cases, and headache in one.

No patient was "sick" in the usual sense. Only one mentioned that she was "sick" twice; the others admitted it after direct questioning. Uncontrollable patients were two foreigners and an Englishwoman. Some patients felt nauseated after ether, but seemed to think the nausea was of no account.

Ill Effects on the Child.

The ill effects on the child were not all attributable to ether. Anencephaly occurred in one case, the fœtus was a monster in one case, *asphyxia livida* was present in eight cases and *asphyxia pallida* in two. Fœtal distress occurred in five cases and a macerated fœtus was present in one case. The child was stillborn, owing to a short cord, in one case. Intracranial hæmorrhage occurred in two cases; both babies survived and recovered completely.

Complications of Labour.

The following complications of labour occurred. In the first stage, primary inertia and prolapsed cord were each present in one case. In the second stage, perineal laceration occurred in thirty-four cases and episiotomy was required in four cases. In the third stage, *post partum* hæmorrhage occurred in eleven cases, being moderate in eight and severe in three. Retention of the placenta occurred in one case and *post partum* eclampsia in one case.

Analysis of Cases of Post Partum Hæmorrhage.

In Table I the details of the cases of *post partum* hæmorrhage are given.

Administration of the Ether.

Ether was administered by the patient herself part of or all the time in 186 cases; it was administered by a trainee nurse or student as well the patient in 112 cases, by a trained nurse as well as the patient in 43 cases, and by a doctor as well as the patient in 23 cases.

Ether was entirely self-administered throughout by at least 24 women. A student, nurse, staff-nurse, sister or doctor administered ether towards the end in the remaining cases (about 176). In 14 cases the patient did not give herself the ether at all. These were patients admitted to hospital in strong labour, who had ether for only five to fifteen minutes, or patients who were unable to manage it themselves; some were given ether by the nurses for experience.

Induction of Anæsthesia.

Anæsthesia was induced by this apparatus 165 times for the following reasons: birth of the head, 127 times; perineorrhaphy, 22 times; episiotomy, 4 times; forceps delivery, 11 times; manual removal of the placenta, once.

The total number of forceps cases was 14 (less one student's case), and four of these patients had kelene and ether on an open mask: three because there was no apparatus available, and one because she was uncontrollable with the apparatus, which is slower in action than kelene and ether. The forceps rate was thus approximately 6%. In twelve additional cases anæsthesia for perineorrhaphy was induced by means of an open mask.

Anæsthesia for birth of the head only was light; but it was made deep enough for forceps and perineorrhaphy, manual removal *et cetera*. I do not think full surgical anæsthesia for an abdominal operation, such as Cæsarean section, could be

TABLE I.

Degree of *Post Partum* Hæmorrhage.	Case Number.	Associated State.	Duration of Labour.	Amount of Ether Used.	Remarks.
	1	Primary inertia.	7 hours.	315 cubic centimetres (10½ ounces).	*Primipara*; forceps delivery.
Severe	2	Preeclampsia.	3 hours.	90 cubic centimetres (3 ounces).	*Multipara*; hæmorrhage one hour after.
	3	—	1½ hours.	45 cubic centimetres (1½ ounces).	*Multipara*; hæmorrhage one hour after.
	1	—	2½ hours.	135 cubic centimetres (4½ ounces).	*Multipara*; hæmorrhage one hour after.
	2	Delayed second stage.	9 hours.	270 cubic centimetres (9 ounces).	*Primipara*; forceps delivery.
	3	Uncontrollability.	—	—	*Primipara*; failure; forceps delivery under kelene and ether.
Moderate	4	—	4½ hours.	150 cubic centimetres (5 ounces).	*Primipara*; hæmorrhage half an hour later.
	5	—	4½ hours.	150 cubic centimetres (5 ounces).	*Primipara*.
	6	—	2½ hours.	75 cubic centimetres (2½ ounces).	*Multipara*.
	7	—	3 hours.	60 cubic centimetres (2 ounces).	*Multipara*.
	8	—	2 2/5 hours.	120 cubic centimetres (4 ounces).	*Multipara*.

induced with this apparatus, which was primarily intended for analgesia alone.

Relief from Pain.

No premedication or sedatives were used and ether was the sole drug giving relief.

Failures.—There were six failures. These patients said they had no relief at all. One was an obstreperous foreigner, who would not take ether from the apparatus, and eventually had open ether for forceps delivery on account of a persistent occipito-posterior presentation. The second failure was in a case of entirely self-administered ether. The third patient felt no relief till anæsthesia was induced by a student. The fourth and fifth patients had had ether anæsthesia for previous operations, and would not take ether; they said they did not like the smell, and it suffocated them. The sixth patient was a foreigner who was uncontrollable in labour, and she fought, scratched and bit the nurses.

Moderate Relief.—Forty-two patients said they had moderate relief. They seemed to think it could have been better, but were satisfied.

Great Relief.—One hundred and thirty-seven patients were most enthusiastic about the ether, and were almost lavish in their expressions of gratification.

Total Relief.—Total relief from pain was experienced by fifteen patients, who felt absolutely no pain whatsoever—only strain.

It appears there is considerable variation in the effect of ether as an analgesic, and some experience is necessary in order to get the best results. Most of these patients had fixed trial ratios given by students and nurses. In the small number of my own private cases I was able, by varying the ratio, to give great relief to a very high percentage of patients.

I am certain now that the number of patients with great relief could have been increased if the ratio had been advanced till the patient expressed herself satisfied. Variations are due to differences in instructions, intelligence, depth of respiration and individual susceptibility to ether. The frequent changes of pupil nurses and students gave them little opportunity of becoming experienced; but the staff nurses and sisters at the Royal Hospital for Women have become experts and are able to give marked relief in the majority of cases. The resident medical officers are rarely called up now.

Mothers' Remarks Concerning Relief Obtained.

Usually the patients were questioned some days after delivery. Four expressed disappointment and dissatisfaction; but one of these said she did not seem to be able to use the apparatus properly herself, although it was satisfactory at the end when the ether was given by a student. Of the moderately relieved patients, some said it was not "strong enough", others that there was some relief, or that it was satisfactory but could have been better. Others again said it gave a fair amount of relief. Another said it took away the strength to bear down, but relieved the pain. I personally gave this patient the ether, as she was uncontrollable without it till I began using it for the last twenty minutes of her labour. Another group said they felt the birth and it was painful, but not unbearable. Others said that relief was given, but not so much as when a student or nurse administered the ether. Still others said that they suffered pain, but not nearly as much as without the apparatus.

Many used such expressions as the following: "It was wonderful"; "It was divine"; "I felt the baby being born, but it didn't hurt"; "I felt them pushing and heard the nurses talking all the time, but it all seemed a long way away"; "It was marvellous"; "It was pretty good"; "It was real good". One said "The pain was numb, just like hitting your finger with a hammer"; another said "It was lovely". One woman said: "My word it was wonderful; I could not feel a thing when the baby was being born." Several said they seemed to be dazed or in a dream while using it. Another group said they went numb all over and the pain was only dull. Another, when asked how she liked the ether, replied that she did not like ether, but she "had the stuff in the 'black box', and it was much better". Four said they did not remember a thing after beginning to take the ether; these were overdosed and really in the first stage of anæsthesia. Although they would answer questions and do what they were told, they had no memory of anything. One of these had her baby with two and a half hours' labour on a ratio of one-eighth. The rest of them (10) were conscious and felt no pain at all—only the strain and the bearing down "movements".

Observers' Remarks.

The patient who had ether for seventeen hours was a *primipara*, aged forty years, with a dead fœtus; she was too tired to hold the mask on herself at the end, but it had given her wonderful relief.

The patient with primary inertia and long-drawn-out painful first stage was relieved; but I think that ether is unsuitable in these cases, and it is much better to give morphine. The patients become tired and unable to use any self-administered analgesic after a number of hours. In some cases the ratio should have been higher. It was gradually learned that the effective ratio varied considerably.

Amount of Ether Used.

The largest quantity of ether used was 750 cubic centimetres (25 ounces) in a seventeen-hour labour, which included a long and difficult forceps delivery, manual removal of retained placenta and colpoperineorrhaphy, all carried out under anæsthesia induced by a nurse with the apparatus.

The smallest quantity used was 15 cubic centimetres (half an ounce) in twenty minutes, with great relief.

The average amount used was 108 cubic centimetres (3·6 ounces) in 2·3 hours, or 45 cubic centimetres (one and a half ounces) per hour.

These figures do not represent a true average, because in some cases (about twenty) kelene and

ether anæsthesia was used for forceps delivery, or perineorrhaphy, or breech delivery; this was because no apparatus was available, all being in use. Nevertheless, this is a very fair average when compared with 750 cubic centimetres (twenty-five ounces) in seventeen hours' labour, *plus* forceps delivery, manual removal and colpoperineorrhaphy.

The Percentage of Ether Vapour Producing Analgesia.

Dr. J. E. Mills, of the Department of Inorganic Chemistry, University of Sydney, has very kindly examined the ether mixture inhaled at a ratio of one-eighth, and has found the percentage by volume to be 3% approximately.

Conclusions.

A certain psychological effect must be produced by any apparatus, as the patient feels she is "getting something anyhow". One effect was that the sounds of straining and calling out were smothered in the face-piece, and the labour ward became a place of relative quietness; there was an absence of the screaming and cries which formerly made it a place of terror to some.

I think it can fairly be claimed that ether as an analgesic and anæsthetic administered by any apparatus or method is an easy, effective and safe agent for relief of pain in labour under practically all conditions; and on account of its greater safety it is to be preferred to chloroform.

Acknowledgements.

I am indebted to my colleagues at the Royal Hospital for Women for permission to use their cases for this investigation.

The credit for the detailed notes and observations, which added tremendously to their routine work, goes wholly to the labour ward nursing staff; and to them I express my gratitude for their cooperation.

References.

(1) H. Buschbeck: *"Die geburtshilfliche Durchtrittsnarkose für Klinik und Privathaus"*, *Deutsche medizinische Wochenschrift*, Volume LXI, October 18, 1935, page 1670; *"Die Durchtrittsnarkose für die Klinische und häusliche Geburtshilfe"*, *Schmerz Narkose-Anæsthesie*, Volume VIII, June, 1935, page 47.

(2) A. W. Bourne and J. H. Burns: "Action on the Human Uterus of Anæsthetics and Other Drugs Commonly Used in Labour", *The British Medical Journal*, Volume II, July 19, 1930, page 87.

(3) A. W. Bourne: "Treatment of Acute Gonorrhœal Salpingitis", *The Journal of Obstetrics and Gynæcology of the British Empire*, Volume XXXIV, 1927, page 249.

(4) K. Lloyd Williams: Anæsthesia and Analgesia in Labour", 1934, page 53.

GETTLER'S TEST IN CASES OF DROWNING.

By ARTHUR PALMER, M.B., F.R.C.S. (Edinburgh), *Sydney.*

A TEST for drowning was described by Gettler, of the United States of America, in 1921, and its value was confirmed by Yamikami, of Tokio, in 1923. It has been used regularly at the Sydney morgue; but it receives very little mention in text-books of forensic medicine. Of two well-known English text-books the latest edition of one mentions it, but in a way indicating that the author had not used it, whilst in the other the test is not mentioned. As the water in which the person is drowning passes into the lungs, there will be an interchange between the fluid in the lungs and the blood circulating in the lungs, so that in drowning in salt water more chloride will be found in the blood from the left side of the heart than in the blood from the right side. In drowning in fresh water the reverse will be the case.

The chloride content calculated as sodium chloride in milligrammes per 100 cubic centimetres is approximately: in salt water, 3,100; in blood, 450 to 500; in fresh water, 4 to 15. It is obvious that the difference between the chloride content of the blood in the right and in the left ventricle will be much greater in drowning in salt water than in fresh water. In drowning in salt water the difference is, in our experience at the Sydney morgue, always more than 50 milligrammes per 100 cubic centimetres, usually more than 100, and occasionally several hundred. In the last six people drowned in salt water, in whom this test was carried out, analysis showed the following excess on the left side: 198, 201, 86, 500, 98 and 194 milligrammes per 100 cubic centimetres respectively. In one case examination showed 531 on the right and 1,031 on the left, a difference of 500 milligrammes—easily the greatest we have seen.

At the autopsy, as soon as the pericardial sac is opened the right ventricle is opened and one or two ounces of blood are drawn off by a syringe and transferred to a clean bottle, which should have been previously labelled. The heart is then raised by its apex and the left ventricle slit up and a corresponding amount of blood removed and placed in another bottle. As death from drowning is an asphyxial one, there are usually few, if any, clots to interfere with the procedure.

These tests have been carried out by the Government analyst, Mr. S. G. Walton. We look upon the test as practically conclusive of drowning in salt water. It cannot, however, be carried out when decomposition is present to any extent, owing to the displacement of blood by gases; nor is it reliable if the *foramen ovale* is patent. Some authorities state that the fluid in which a person drowns does not enter the lungs. In view of the results of the test this view does not appear to be tenable. It is stated also that in some cases of drowning death takes place before the water enters the lungs, by reflex inhibition or other cause. In such circumstances this test would not be available. This cause of death must, I think, be rare, and we are not aware of having seen an instance.

The test is not so valuable in drowning in fresh water, the difference in chloride content being quite small, though the excess should be on the right side of the heart. The last three instances showed an excess in the blood of the right side of 7, 16 and 19 milligrammes respectively per 100 cubic centimetres.

PRELIMINARY OBSERVATIONS ON THE VIRUS RESPONSIBLE FOR THE VICTORIAN AND TASMANIAN EPIDEMICS OF POLIOMYELITIS, 1937.[1]

By F. M. BURNET

AND

E. V. KEOGH,
Virus Research Officer, Commonwealth Serum Laboratories.

(From the Walter and Eliza Hall Institute, Melbourne.)

In view of the rather unusual character, particularly in the early stages, of the Victorian and the associated Tasmanian epidemic of poliomyelitis in 1937, the isolation of the virus from several fatal cases was made in order to establish that the infections were due to the usual type of virus.

Through the cooperation of the Fairfield Infectious Diseases Hospital and the Commonwealth Health Department Laboratory in Launceston, several spinal cords from fatal cases were received, either fresh or in glycerol-saline solution. Material from three cords from early Victorian cases was inoculated intracerebrally into monkeys (*Macacus rhesus*), two monkeys receiving pooled material from cases Da and Pi, and two being inoculated from case Pr. In November, cords from two early Launceston cases, De and Ma, were each inoculated into monkeys. Seven of the eight inoculated monkeys showed typical symptoms of poliomyelitis. The other died three days after inoculation from a cerebral abscess, from which pneumococci and staphylococci were isolated.

Results of Inoculation.

Brief notes of these primary investigations are as follows.

I. *Case Pr.*—Monkey 3, inoculated intracerebrally, suffered from tremor on the fifth day and was prostrate on the following day. It was still alive on the seventh day, when it was killed to provide stock virus.

Monkey 4, inoculated with the same material, had a definite tremor on the seventh day; it had disappeared two days later. At the sixteenth day there was distinct weakness of all limbs; but no local paralysis developed, and three weeks later the monkey appeared to be normally active.

II. *Pooled Cords from Cases Da and Pi.*—Monkey 5 suffered a rise of temperature to 40·6° C. (105° F.) on the fourteenth day, and was weak and tremulous on the following day. Paralysis spread slowly, and the animal was prostrate on the nineteenth day. It fed well and recovered. Five weeks after inoculation it had almost complete paralysis of the hind limbs and some weakness in the arms, but could pull itself up to a sitting position, and appeared in good general health.

Monkey 6 had tremor in three days, followed by rapid paralysis. It was killed when prostrate on the fifth day.

III. *Case De.*—One of the monkeys, M.19, inoculated with this material, developed atypical symptoms and died on the third day from a cerebral abscess at the point of inoculation. The temperature of monkey 18 rose to 40·2° C. (104·3° F.) on the fifth day and the animal was paralysed in the legs and to a less extent in the upper limbs when killed on the following day. Attempts at culture of organisms from brain and cord were unsuccessful.

IV. *Case Ma.*—The infection in monkey 20 ran an unusual course. The temperature rose to 40·2° C. (104·3° F.) on the fourth day and remained about that level for three days. On the seventh day it reached 41·6° (106·8° F.) and on the eighth day 41·1° C. (106° F.). The temperature was normal, around 39·4° C. (103° F.), for two days and rose on the eleventh day to 40·3° C. (104·5° F.). At this time paralysis was first noted. Almost complete flaccid paralysis of the right arm was present, together with some tremor of the right leg. No further extension occurred, and the animal recovered.

Monkey 21 had tremor and slight weakness on the fifth day and was almost completely paralysed on the sixth day, when it was killed.

In summary, all the inoculated monkeys had typical symptoms, with some variability in the incubation period. The shorter the incubation period, the more severe were the symptoms. On the whole, the virus appears to be more readily transferred to the monkey than strains obtained in non-epidemic periods.

The variability in intensity of symptoms was also evident in subinoculations. Pooled virus from monkeys 3 and 6 was inoculated to monkeys 7 and 8. One had tremor on the thirteenth day, with some weakness, but recovered without paralysis, while monkey 8 had typical acute paralysis and was killed when prostrate on the seventh day. Subinoculation of strain De to monkey 25 caused typical paralysis complete on the seventh day, while monkey 26, inoculated from monkey 21 (strain Ma), had a sharp temperature rise to 41·1° C. (106° F.) on the fifth day, but developed no paralysis apart from a transient tremor in the right arm and leg.

Immunity of Monkeys that had Recovered from Inoculation with Strain MV.

Most of the monkeys which were allowed to survive were tested by intracerebral inoculation of the Rockefeller Institute strain MV. This strain, in our experience, as well as that of many others, invariably produces fatal paralysis in normal monkeys within seven days. The results obtained with four monkeys that had recovered were strikingly uniform. They are shown in Table I. All showed clear evidence of infection with MV. strain in the form of a febrile reaction, ruffled fur and tremor. Two had a definite increase in paralysis; but all survived. The results are quite similar to those obtained by Burnet and Macnamara[(1)] in 1930, and since confirmed by a number of American authors. They show that the recently isolated strain has a significant antigenic resemblance to the classical MV. strain of poliomyelitis virus, since monkeys that have recovered from infection with the recently isolated strain survive inoculation with many certainly lethal doses of the MV. strain. The strains, however, are not identical, MV. being capable of producing symptoms in the immune monkeys very similar to those resulting from inoculation of a weak poliomyelitis strain in non-immune animals.

[1] The carrying out of this work was assisted by a grant for research on virus diseases from the Rockefeller Foundation and the Commonwealth Government Department of Health.

TABLE I.

Immunity Tests of Monkeys Recovered from Infection with Local Poliomyelitis Virus.

Monkey.	Previous Inoculum.	Result of Intracerebral Inoculation with MV.		
		Maximum Temperature.	Day.	Results.
5	Da and Pi (original).	40·4° C. (104·7° F.)	Fourth.	Tremor and some increase in paralysis of arms survived.
7	Pooled Pr, Da, Pi (after one passage).	41·3° C. (106·3° F.).	Sixth.	Tremor and paralysis of legs; survived.
20	Ma (original).	40·6° C. (105·0° F.).	Sixth.	Tremor, no increase in paralysis; survived.
24	Ma (after one passage).	40·3° C. (104·5° F.).	Fourth.	Tremor very obvious, but no increase in paralysis; survived.
9	Nil.	—	—	Prostrate fifth day.

Summary.

1. A typical poliomyelitis virus has been isolated from spinal cords of several patients who had died during the Victorian and Tasmanian epidemics of poliomyelitis of 1937.

2. Monkeys recovered after infection with the virus are still partially susceptible to infection by the Rockefeller Institute MV. strain.

Reference.

(1) F. M. Burnet and J. Macnamara: "Immunological Differences between Strains of Poliomyelitic Virus", *The British Journal of Experimental Pathology*, Volume XII, 1931, page 57.

Reports of Cases.

TWO CASES OF GLANDULAR FEVER.

By G. ATKIN SAMPSON, M.B., Ch.M.,
Brisbane.

Case I.

J.M., A GIRL, aged nearly three years, had seemed temporarily slightly indisposed on September 10, 1937, on which day, and possibly before, she had drunk water from a tank, above which had been filthy sparrow nests. On September 13 she became ill, complaining of pains in the neck and near the navel. I saw her on September 14. She was feverish; the *glandulæ concatenatæ* were slightly swollen; the abdomen was soft. Next day she had diarrhœa. Nevertheless, subsequent costiveness was a feature of her illness. No vomiting occurred.

Four days later the child felt somewhat better. There had not been any otitis nor any tonsillitis. Continued anorexia was present; the tongue was heavily furred. A test of urine had shown no albumin, and there was a very doubtful diazo-reaction.

On September 21, 1937, the child's condition was worse. The temperature was 38·1° C. (100·6° F.), the pulse rate was 124 and the respiration rate 36 per minute. She was still spending restless nights and perspiring a good deal; the eyes looked very tired and the lids puffy. The cheeks were flushed; but there was circumnasal and circumoral pallor. The nasal passages had become blocked and tenacious stringy mucus was coming therefrom. The tonsils were enlarged, but were not reddened, and showed white points of secretion. The glands behind the angle of the jaw, especially on the left side, were somewhat swollen and tender. By pressing one's fingers under the ribs the edge of the spleen could just be felt.

Next day the temperature was 38·7° C. (101·6° F.), the pulse rate 144, and the respiration rate 36 per minute. The child looked ill. The spleen was beginning to enlarge to a point beyond the margin of the ribs.

A blood count excluded typhoid, the leucocyte count being 22,700 per cubic millimetre. A few of the leucocytes were polymorphonuclear cells and small lymphocytes; there was a very great preponderance of large cells having a single nucleus, which might be round, oval, notched, kidney-shaped, bent or roughly triangular or quadrangular.

The diagnosis was glandular fever (infectious mononucleosis); but could acute leuchæmia be excluded? Though different features will be present in different cases, I was heartened on reading under "Glandular Fever" in Musser's "Internal Medicine" (1935) that "the nose is often obstructed by swelling of the mucosa", and in Monro's "Manual of Medicine" (1927) that "there is tenderness in the anterior triangle of the neck, usually on the left side", and in Beaumont's "Medicine" (1934) that glandular fever "tends to occur in the winter and spring".

The febrile illness continued. On September 23, 1938, the tonsils were larger, not reddened, and were marked with isolated white spots; the lower border of the spleen was palpable nearly two fingers' breadth beyond the ribs. The child secured a good rest the next night, and on September 24 the temperature was 37° C. (98·6° F.). The cervical glands were slightly smaller. Tiny glands were palpable in the axillæ; the spleen was not increasing in size. The patient was peevish. Three small purpuric spots appeared inside the right cheek; but these fortunately vanished after a few days. The urine also now contained a small quantity of albumin, which persisted for about a week. The swelling of the spleen and the glands receded quickly. Appetite, which had been absent, slowly returned. Energy returned very much more slowly. There was never any cough.

Beaumont states that the spleen may be felt in about one-third of the cases. The blood changes may be of very short duration. Musser mentions that, according to the stage of the disease, the leucocytes may number only 3,000 per cubic millimetre, and that there is at first a slight increase in polymorphonuclear cells. It is obvious that many cases, especially those with a shorter febrile period, could remain undiagnosed.

Case II.

M.M., a boy, aged eleven years, J.M.'s brother, was said by his mother to have been languid for some days and then feverish for about eight days prior to December 10, 1937, when his temperature reached its highest, namely, 39·4° C. (103° F.). She had noticed enlarged glands in the neck and puffiness round the eyes. I first saw the patient on December 11, 1937. His temperature was 38·3° C. (101° F.). He did not look very ill. There was now no puffiness round the eyes. Conjunctivitis was present. The lower part of the face and particularly the upper part of the neck had an œdematous appearance. The submaxillary glands and the glands at the back of the neck were enlarged. The nasal passages had become partially blocked. Follicular tonsillitis was present. A punctate purpuric appearance was present in the middle of the palate. The spleen was palpable. There was a slight cough.

Next day the blood was examined. The leucocyte count was 15,900 per cubic millimetre, and 12% only were polymorphonuclear cells. The remaining 88% resembled large lymphocytes; their nuclei were fairly bulky and were either round, oval or kidney-shaped; they were therefore very even in appearance. There were no leucocytes with

bent nuclei situated towards one side of the cell, such as had been seen in his sister's film. No small lymphocytes were seen.

On the same evening the temperature was 37·8° C. (100° F.); but it subsided to normal next day, when the lymphatic glands were smaller, though the spleen could still be felt.

On December 16 the spleen had receded; there was a slight amount of albumin in the urine; three days later this had vanished. The patient is now well.

Reviews.

A TEXT-BOOK OF MEDICINE.

THE third edition of Beaumont's "Medicine" has been very thoroughly revised, but, as the author states in the preface, it has retained its youthful figure.[1] All the essentials of clinical medicine are compressed into its 733 pages. The book is obviously written by a practising physician of wide experience who is well conversant with recent advances. The descriptions of the clinical findings and the treatment of each disease are particularly good. Useful prescriptions are given on nearly every page, and there is a good index. The question of diet receives careful attention throughout the book, and many of the diets recently in vogue are included, for example, Furstenburg's diet for Ménière's syndrome, and that of Meulengracht for hæmatemesis. The raw apple diet used in the treatment of diarrhœa in children might have deserved inclusion. The newer drugs are also described, including sulphanilamide, benzedrine, ammonium mandelate, gold salts and protamine insulin. There are many references to the use of rectal glucose, but careful study by Corkill (THE MEDICAL JOURNAL OF AUSTRALIA, June 13, 1936) appeared to show that glucose is not absorbed by the rectal mucosa.

The author believes that "Eumydrin" (an atropine derivative) promises to replace surgical interference in the treatment of congenital hypertrophic stenosis of the pylorus. He states on page 61 that constipation may lead to various toxic states, such as fibrositis and neuritis. Many authorities might doubt this. He denies that the examination of bile withdrawn from the duodenum by the Lyons method is of any practical value. Hanot's cirrhosis is considered a clinical entity (page 80), and Arnold Rich's classification of jaundice finds favour.

The author evidently does not think highly of the much-discussed treatment of hay fever by zinc ionization. He suggests that the induction of artificial pneumothorax is a suitable mode of treatment in cases of early bronchiectasis and pulmonary abscess, but the risk of such a complication as pyopneumothorax deters many physicians from using this method. He prefers intravenous chrysotherapy to the use of the intramuscular route in the treatment of phthisis.

In the chapter on cardio-vascular diseases it is refreshing to find that the usual dissertations on the fatty heart, primary heart strain and chronic myocarditis have been omitted. We cannot agree that *angina pectoris* is most commonly associated pathologically with syphilis. Atheroma is surely a more common cause, in Australia at all events.

The author devotes 158 pages to the nervous system. Several useful diagrams are included in this section. Convalescent serum is still advocated for the treatment of acute anterior poliomyelitis. In a description of the signs of abscess of the temporo-sphenoidal lobe it is stated (page 304) that there may be deafness on the opposite side. If it is meant by this that the deafness is of cortical origin, neurologists would disagree, since, according to Collier, there is complete semidecussation of the auditory path. Psychoanalysis is not recommended for the treatment of anxiety states and hysteria. The myopathies and *myasthenia gravis* are taken out of the section on nervous diseases and are described under diseases of the locomotor system, which includes affections of the muscles, bones and joints. It is rather confusing to find Oppenheimer's disease, or *amyotonia congenita*, given the alternative name of *myotonia congenita*. The latter is the usual name of Thomsen's disease, and this is described here under the name of *myotonia congenita* also.

No mention is made of local sepsis in relation to dermatomyositis, an important factor according to some authorities. The vexed question of the classification of nephritis is discussed, and that of Fishberg is adopted. One page 461 the reader is left in slight doubt as to the significance of the presence of tubercle bacilli found in urine. It appears to be accepted now that their presence definitely indicates the existence of renal tuberculosis. For the relief of the rheumatic complications of scarlet fever "Atophan" is recommended (page 519), but many physicians have abandoned the use of this drug on account of its toxic effect on the liver. However, in discussing its action in gout, the author gives due warning of this danger. In very severe cases of diphtheria treatment with 70,000 to 200,000 units of antitoxin, together with two cubic centimetres of a 1 in 1,000 solution of adrenaline hydrochloride (to prevent anaphylactic shock) is recommended. The large dose of adrenaline is surely fraught with danger unless it is given extremely slowly.

Many Australian surgeons would not agree that a person suffering from thyreotoxicosis should be given medical treatment, including Lugol's solution, for six months before a decision is made as to whether an operation is necessary or not. The optimum time for surgical interference after iodization would be lost, and once lost could not be regained. The author states on page 668 that morphine and opium should never be prescribed for cholera, and yet on the same page recommends chlorodyne for this disease. These are minor objections, however, and subject to the judgement of individual opinion.

The views set forth in the book are in accord with the best London teaching. The matter is concise, the print is clear, and printer's errors are conspicuous by their absence. The book can be recommended with every confidence.

[1] "Medicine: Essentials for Practitioners and Students", by G. E. Beaumont, M.A., D.M., F.R.C.P., D.P.H.; Third Edition; 1937. London: J. and A. Churchill Limited. Medium 8vo, pp. 793, with 74 illustrations. Price: 21s. net.

PHYSICAL SIGNS IN CLINICAL SURGERY.

THE sixth edition of Hamilton Bailey's well-known book "Physical Signs in Clinical Surgery" has just appeared,[1] and as it naturally differs but little from the previous edition, it is difficult to criticize anew. As the author himself points out, physical signs are immutable and the methods of their detection have not changed.

Criticism must be levelled at the method advocated, on page 60, for determination of the relationship of a cervical swelling to the sterno-mastoid muscle. As is pointed out, this test depends upon making the patient tighten the sterno-mastoid by active contraction. A surgeon has only to think of the posture of the head in torticollis to realize that the muscle will be rendered taut only by attempted rotation of the head against resistance, not by depression of the chin. This error should not be repeated in future editions, and future editions there certainly should be. As before, the author and publishers have combined to produce a book invaluable to every student, a book which has not been bettered.

[1] "Demonstrations of Physical Signs in Clinical Surgery", by H. Bailey, F.R.C.S.; Sixth Edition, revised; 1937. Bristol: John Wright and Sons Limited. Medium 8vo, pp. 296, with 358 illustrations, some of which are in colour. Price: 21s. net.

The Medical Journal of Australia

SATURDAY, JULY 23, 1938.

All articles submitted for publication in this journal should be typed with double or treble spacing. Carbon copies should not be sent. Authors are requested to avoid the use of abbreviations and not to underline either words or phrases.

References to articles and books should be carefully checked. In a reference the following information should be given without abbreviation: Initials of author, surname of author, full title of article, name of journal, volume, full date (month, day and year), number of the first page of the article. If a reference is made to an abstract of a paper, the name of the original journal, together with that of the journal in which the abstract has appeared, should be given with full date in each instance.

Authors who are not accustomed to preparing drawings or photographic prints for reproduction, are invited to seek the advice of the Editor.

LOBAR PNEUMONIA.

In Australia the treatment of patients suffering from pneumococcal lobar pneumonia is much as it was twenty years ago. The great advances in specific therapy remain almost unheeded. Few medical men see enough patients to make them fully appreciate the danger of pneumonia to the community or to stimulate them to seek more satisfactory methods of treatment. Lobar pneumonia occurs during a brief season only, and its incidence is low; yet in New South Wales alone, from 1932 to 1936, it caused, on an average, 630 deaths *per annum*. The number of deaths from pneumonia is increasing, and apparently the proportion of deaths from this cause is also increasing.

Serum therapy is of proven value in infections with pneumococci of Type I and Type II, has little effect when Type III is the infecting organism, and is of considerable value in infections with many of the numerous types in Group IV. In the United States of America and some other countries the relative prevalence of the various types of pneumococcus in lobar pneumonia is known. It has been found in the United States of America that Type I or Type II is the responsible organism in over 50% of cases. The importance of this is obvious when it is remembered that specific therapy has been found to be most valuable in infection with organisms of these types. In Australia little is known of the prevalence of the various types.

In the preceding issue of this journal the attention of readers was drawn to the work of typing pneumococci now being carried out at the Kanematsu Institute of Pathology at Sydney Hospital. This work has been made possible by a grant from the National Health and Medical Research Council. Arrangements have been made with various metropolitan hospitals for the supply of material; but this will not be sufficient. Every medical practitioner in New South Wales should forward a sample of sputum voided by every pneumonia patient under his care. The sputum should be fresh if possible; but typing of organisms is still practicable in many cases forty-eight hours after the sputum has been voided. Medical practitioners should therefore dispatch samples for investigation even though there might be some delay in transport. The actual process of typing occupies a few minutes when circumstances are favourable, and a few hours when they are not. It is this rapidity of typing that makes serum therapy practicable. It is useless and wasteful to administer an antiserum that is not truly specific. Some writers have recommended the administration of antiserum of Type I and Type II as a routine, on the chance that the infection is of one of these types; but this is hardly scientific and is certainly uneconomical.

An obstruction to the advancement of specific therapy in Australia has been the high cost of the antiserum. Felton's serum, which is concentrated and has a minimum toxicity, is subject to a very high customs duty, and no serum of similar concentration has so far been prepared in Australia. The Commonwealth Government would do a service to the nation if it waived this duty. In the United States of America government assistance is provided when necessary for the purchase of antiserum. We would commend this practice also to the Commonwealth Government.

The work of typing pneumococci now being carried out at the Kanematsu Institute is of national importance, and we would urge medical practitioners to do their best to assist it. We hope that similar work will be carried out at all large centres throughout Australia.

It will be necessary to continue these investigations for a number of years before a reasonable conclusion concerning the prevalence of the various types of pneumococci can be arrived at. By that time perhaps antisera for infections with all the various types will be readily available in Australia, and typing will be a routine procedure in even the most remote places.

Current Comment.

VISCERAL PAIN.

THE question of the mechanism of visceral pain can by no means be regarded as settled, in spite of many years of clinical observation and experimental work. However, modern opinion seems to have struck a balance between two chief opposing views: that of Mackenzie, who regarded all visceral pain as being "referred" to some somatic structure by means of an "irritable spinal focus", which facilitates the passage of painful impulses from the appropriate somatic segment; and the view that impulses arising in the viscera have a direct pathway to the sensorium.

In view of the work of Hurst, Lewis, Lemaire, Morley, Weiss and Davies, Barron and Matthews and many others, most authorities nowadays agree that the production of visceral pain involves a dual mechanism. In the first place "referred" or "transferred" pain undoubtedly exists, as exemplified by shoulder pain of phrenic origin. It is a constant type of pain and is associated with hyperæsthesia and sometimes with muscular rigidity; it is abolished by subcutaneous infiltration of the painful area with "Novocain". In most cases it is believed to be caused by irritation of somatic nerve-endings; for example, those in the subperitoneal plexus. These impulses enter the spinal cord via somatic nerves. Many of them almost immediately overflow from the posterior columns along collaterals which pass through neighbouring posterior rootlets, and so reach the skin by the ordinary sensory nerves of the appropriate segments. At the periphery some change is wrought, probably chemical, which stimulates the ordinary pain nerve-endings of the skin.

In the second place, true splanchnic pain also occurs, the adequate stimulus being tension in the walls of hollow viscera. The impulses giving rise to this type of pain travel to consciousness without the mediation of somatic pathways. The pain is vague, ill-localized and deep-seated, and is characterized by colicky spasms. It is seen typically in uncomplicated intestinal obstruction.

Experimental work on the subject of visceral pain is greatly handicapped by the difficulty of recognizing the occurrence of painful sensations in laboratory animals. Robert M. Moore[1] has recently described a number of animal experiments in which a new method of visceral stimulation was used. This consisted in the injection of irritating solutions into various visceral arteries. He used decerebrate or barbitalized cats and assumed the occurrence of painful stimulation when "pseud-affective" reactions took place, namely, pupillary dilatation, movements of limbs and jaws, snarling, changes in blood pressure and changes in respiration. Moore concludes that the pain endings stimulated by his injections were situated in the peripheral tissues supplied by the artery concerned, because innocuous solutions produced no effect, because central injection into a vein caused no response, because after ligation or embolic obstruction of the arterial branches no reaction occurred, and finally because there are no demonstrable nerve-endings in arterial intima or in capillary endothelium. He believes that the irritant solutions diffused rapidly into the tissue spaces and there stimulated a large number of pain endings simultaneously.

In the course of these experiments most of the viscera, including the heart and lungs, were stimulated in this way, and the results appear to justify the conclusion that some degree of pain sensibility is present in all organs. By combining this method of painful stimulation with nerve section, Moore made a number of general observations on visceral pain pathways. He came to the conclusions *inter alia* that sensibility of the viscera does not depend on the subperitoneal nervous plexuses; that all visceral pain impulses enter the cord through the posterior roots; that the vagus nerves contain no pain fibres from the abdominal viscera, whose pain pathways pass through the splanchnic nerves and sympathetic trunks; and that painful impulses from the heart pass by way of the upper thoracic ganglia and not through the cervical sympathetic chain.

More illuminating are some observations on the pain-producing properties of different solutions. It was found that any hypertonic solution above half-molar strength was irritating to pain nerve-endings. Similarly, any hypotonic solution which was less than one-third isotonic caused stimulation. Isotonic solutions with a pH above 9·2 or below 6·3 were irritating. Thus pain nerve-endings are more sensitive to acid than to base. Neutral isotonic solutions became irritating if certain ions were present, notably those of potassium, rubidium and barium. This finding agrees with the work of

[1] *Surgery*, April, 1938.

Bommer, who found that weak solutions of potassium salts, injected intradermally, caused burning pain. Pain in active, ischæmic muscle, whether skeletal or cardiac, is now believed to be caused by the accumulation of some metabolic product which stimulates the nerve endings. Moore's finding that solutions of a pH of 6·3 or less caused pain when injected intraarterially, suggested that a fall in pH might be the necessary painful stimulus in ischæmic, contracting muscle. He estimated the pH of blood in the coronary sinuses of hearts rendered ischæmic by ligation of both coronary arteries. In all cases there was a definite lowering of the pH, in most of them to less than 6·3. This degree of acidity, according to Moore, is enough to cause pain, apart from the nature of the acid metabolites.

In his discussion Moore goes further and suggests that the effective stimulus to pain in any hollow viscus may be chemical, since acid metabolites may accumulate during the ischæmia which accompanies distension or spastic contraction of the viscus. He believes that the apparent insensitivity of viscera to ordinary stimulation is due chiefly to the sparseness of their nerve supply as compared with that of somatic structures, and also to the fact that in the somatic sensory system discrimination and accuracy of localization develop with experience, which is, of course, very limited in the case of the internal organs.

Moore's experimental work, therefore, confirms the modern opinion that true splanchnic pain exists. He does not deal with the subject of referred pain in this paper, though, of course, he recognizes its occurrence. The limited value of experiments on animals must always be borne in mind, especially when the investigator is dealing with such a subjective condition as pain. Nevertheless, Moore's work appears to be a definite contribution to the solution of this fascinating problem.

PAIN ARISING FROM MUSCLE.

THE recent work of Lewis and his colleagues has shown by simple yet conclusive means that pain of different types arises from different somatic structures. The structure stimulated rather than the stimulus itself determines the type of pain felt. Pursuing the investigation of this subject, J. H. Kellgren has studied experimentally the pain produced by the injection of mildly irritating substances into muscle.[1] The chemical solution used in this work was a 6·0% solution of sodium chloride. Injected into muscle in quantities of 0·1 to 0·3 cubic centimetre, it caused pain without provoking undesirable after-effects. Occasionally a nerve trunk was irritated by the injection, but the pain thus arising was distinctive and in no way likely to be confused with muscle pain. Though the method employed was simple, the inquiry called for not a little accuracy of observation and some degree of personal fortitude: Kellgren selected for the purpose himself and his colleagues, who were, as he naïvely remarks, unusually experienced in subjective observation. Studies were made of the different reactions to stimulation of a muscle or its fascial covering. One muscle chosen was the *gluteus medius*. It was found that when a large intramuscular needle was passed through anæsthetized skin it could be freely moved round without causing pain until the gluteal fascia was struck, whereupon both operator and subject experienced an easily recognizable sensation. The localization of the pain was at a spot slightly distal to the needle. A similar sensation could be evoked by the injection of a little 6% salt solution. This fascial pain was easily distinguished, since it was quite different in quality from the pain arising from stimulation of the skin. When the needle was passed on into the muscle a diffuse and more severe pain was felt in the lower part of the buttock and the back of the thigh, sometimes even as far down as the knee. It is curious that this fascial pain was so localized and the muscle pain so diffuse. Similar observations were made on the effects of stimulation of the fascia, muscle and tendons of a number of subjects. It was found that the pain felt in certain muscles was more severe than in others; in some cases local pain was readily produced, which was believed to be due to the stimulation of fascial elements. Kellgren made other experiments to decide whether muscular pain followed a spinal segmental pattern in its distribution. This was not easy to do, since the pain is of a rather diffuse nature. The conclusion reached was that muscle pain did follow a segmental distribution, though the pattern was different from that of the segmental innervation of the skin. The author believes that referred pain is felt on painful stimulation of muscles, and he found that it was associated with referred tenderness of the deeper structures. This tenderness was deep, not cutaneous, as was proved by his discovery that the injection of a local anæsthetic into the skin failed to abolish the tenderness felt by the subject on deep pressure. It would appear then that muscle pain is a distinctive type of sensation, although it may be confused with the pain arising from other deep structures such as the joints, and that its distribution depends on the anatomical relations of the nervous system. It is not possible, however, to apply the well-known zones of cutaneous sensation to muscle pain, and therefore the familiar diagrams of Head and others cannot be accurately referred to the muscular system. As pain in the deep structural framework of the body occurs so commonly, for example, in the familiar types of chronic rheumatic affections, there is a wide field for accurate clinical observation of the nature and distribution of this type of pain. The physician's natural tendency when pain is felt by the patient in the region of the trunk is to think first in terms of internal organs, but if he puts these simple principles into practice, he might in some cases make a clinical diagnosis without recourse to elaborate investigation.

[1] *Clinical Science Incorporating Heart*, Volume III, Number 2.

Abstracts from Current Medical Literature.

SURGERY.

Hæmangioma of the Rectum.

L. A. BUIE AND J. P. NESSELROD (*Surgery*, March, 1938) describe a diffuse cavernous hæmangioma of the rectum. The tumour formed a diffuse vascular mass composed of blood-filled spaces and resembling erectile tissue which had invaded all the tunics of the rectum except the mucosa. Hæmangiomata have been classified by Bensaudi and Antoine as simple and cavernous, the latter group being either circumscribed or diffuse. Circumscribed cavernous hæmangiomata show little tendency to invasion, and are not rare in the gastro-intestinal tract, being found especially in the cheek, lip, soft palate, tongue, stomach, duodenum, small and large intestine, including the rectum. Diffuse cavernous hæmangiomata have a tendency towards invasion and are most commonly found in the rectum or in the sigmoid colon. Hæmorrhages may be frequent and severe. These tumours are believed to be congenital in origin, and the bleeding may commence in early childhood. There may be rectal pain and tenesmus. The repeated hæmorrhages may lead to hypochromic anæmia. Diagnosis may be made by proctoscopy and biopsy. Digital examination may reveal the nodular character of the involved wall, while on proctoscopy the tumour may appear bluish through the mucosa, giving little indication of the blood vascular structure. Aspiration will reveal blood, but Röntgenological study may not be very helpful, except when the tumour is in the sigmoid. The only means of relief available at present is colostomy, with excision of the affected segment if possible.

Acute Pancreatitis.

W. H. COLE (*The American Journal of Surgery*, April, 1938) discusses acute pancreatitis, with special reference to the pathogenesis and the diagnostic value of the blood amylase test. The acute œdematous (interatitial) type is produced by an obstruction of the pancreatic ducts. This causes swelling of the glands with very little pathological change, except œdema and slight cellular infiltration. The obstruction may be produced in the body of the gland by metaplasia of the intraductal cells, by compression of the main duct by stone, or by compression because of spread of infection from the common duct. The rather rapid clinical recovery of the patient and the subsidence of the elevated blood amylast level within a few days may possibly be explained on the assumption that the pancreatic secretions have established exit through anastomotic channels. If bile is forced up into the pancreatic duct by reflux, as may happen occasionally, the irritating effect of the bile salts would undoubtedly aid in the rupture of small ducts, with escape of pancreatic ferments into the parenchyma of the gland. This rupture of tiny ducts might be brought about by obstruction alone. Necrosis and hæmorrhage are the result of tryptic digestion, but focal areas of necrosis might be produced by local areas of ischæmia resulting from compression incident to the œdema. Suppuration is secondary to bacterial invasion, which probably is very rarely a primary process. The clinical features and treatment are also discussed.

Multiple Gastric Polyposis.

H. BRUNN AND F. PEARL (*The American Journal of Surgery*, April, 1938) discuss multiple gastric polyposis. It may be of congenital or of inflammatory origin, each type having certain gross characteristics by which it may often be identified. In contrast with colonic polyposis, gastric polyposis has no definite hereditary quality, and the tendency to malignant change is less marked and occurs much later in the course of the disease. Symptoms are not characteristic, the commonest being achylia, myxorrhœa and gastric bleeding. Severe gastric hæmorrhage occurred in 8% of the reported cases, but in no instance was it fatal. Achylia is present in 90% of cases. The disease may remain benign for a period of many years. The treatment these authors prefer is radical surgical removal.

Gastroscopy.

H. J. MOERSCH AND A. M. SNELL (*The American Journal of Surgery*, March, 1938) write from the Mayo Clinic on the subject of gastroscopy. After reviewing the procedure, they conclude that it is useful in many fields, especially in cases in which the history suggests organic disease and the Röntgenological findings are negative. Again, where there is a demonstrable lesion of uncertain nature, direct visualization may help. Observation of the progress of lesions under medical treatment is another field of usefulness. Finally, it has been particularly useful in detecting the various degrees and types of gastritis, and in the study of post-operative symptoms after gastric operations.

E. B. BENEDICT (*The American Journal of Surgery*, April, 1938) discusses the importance of gastroscopy in surgical diagnosis. It permits a minute study of almost all the gastric mucosa with the exception of certain "blind" areas. The duodenum cannot be seen. The pylorus can usually be inspected, but an ulcer lying within the pyloric canal will probably not be visible. In a J-shaped stomach it may be impossible to see the lesser curvature of the antrum near the pylorus. This gastroscopic blind spot is due to angulation and is not always present; during the passage of a peristaltic wave the whole lesser curvature may become visible even in a difficult case. Owing to the fact that the objective lens looks at right angles to the axis of the instrument, there is a blind spot on the greater curvature where the tip of the gastroscope impinges on the mucosa. By manipulation of the instrument this area becomes very small. The portion of the fundus above the cardiac orifice and adjacent to the œsophagus is also invisible, but is a relatively unimportant area. The remainder of the gastric mucosa is usually well seen. The indications for gastroscopy and some typical findings are included.

Acute Putrid Abscess of the Lung.

H. NEUHOF AND A. S. W. TOUROFF (*Surgery, Gynecology and Obstetrics*, May, 1938) record a further series of some forty-five patients with acute putrid lung abscess treated by operation. These patients represent the total number treated by operation in a series of more than one hundred cases of acute putrid pulmonary abscess. An acute abscess is defined arbitrarily on the basis of time alone, as one of not more than six weeks' duration after the time of onset of pulmonary manifestations. Unless accurate localization has been achieved, the operation as described is not recommended by these authors. In thirty-four of these patients the abscess was confined to the pulmonary parenchyma, and in the remaining eleven perforation into the pleura had occurred. A single abscess was present in most cases, and the right lung was involved more than twice as often as the left, which supports the aspiration theory of their causation. Typical Röntgenological features were present in only a few cases, atypical features being encountered most often in the severe cases. Diagnostic bronchoscopy located the affected segment with great accuracy. The complication of perforation into the pleura took place most commonly in the second or third week of the illness. Typical clinical manifestations of the acute putrid abscess occurred in only eleven patients. Hæmoptysis was an outstanding feature in four cases. The outstanding clinical feature of perforation into the pleura was an ominous change in the condition of the patient, which occurred with dramatic suddenness. The presence of physical signs of empyema or pyopneumothorax was a definite aid in the diagnosis of perforation, and contrasted with the indefinite physical signs usually found in unperforated abscess of the lung. Elective as well as imperative operative indications are described. Operation is usually performed in stages.

Surgical Catgut.

R. O. CLOCK (*Surgery, Gynæcology and Obstetrics*, May, 1938) records a study of the bacteria found in surgical

catgut. Of 36 brands of catgut examined, 15 brands, or 41%, were found not to be sterile. Of the 589 lots tested, 161 lots, or 27%, contained non-sterile sutures. From the non-sterile catgut sutures 36 spore-forming bacterial species were isolated and identified. These included five strains of sporulating anaerobes. Sutures of some brands of catgut contained non-pathogenic aerobic and facultative spore-forming bacilli, while in other sutures of the same lot were found pathogenic sporulating anaerobes. All the bacteria isolated from these sutures were spore-formers. According to the author, the study confirms what he has stated in a former paper, that the so-called chemical sterilization of surgical catgut by any method yet devised is inefficient and unreliable, and that carefully controlled heat sterilization is the only uniformly reliable and positive method of sterilizing surgical catgut sutures.

Renal Function Following Trauma to Kidney.

J. H. POWERS (*Surgery*, March, 1938), in an experimental study, records the effects of trauma upon the function and structure of the kidneys. Impairment of renal function following trauma of moderate severity is transient. Severe injury is incompatible with life if the opposite kidney has been removed. Extensive trauma to one kidney, if the other organ is intact, may cause no great change in total renal function. The chief pathological changes responsible for the transient impairment of function following injury are degeneration of the tubules, subcapsular and parenchymatous hæmorrhages, œdema and infarction. The results suggest that the majority of patients with unilateral renal trauma may be treated conservatively with the expectation that the injured kidney will recover sufficient function to be a useful and serviceable organ.

Benign Stricture of the Œsophagus Complicating Duodenal Ulcer.

EDWARD B. BENEDICT and ERNEST M. DELAND (*The New England Journal of Medicine*, April 7, 1938) describe a case of benign stricture of the œsophagus probably due to an œsophagitis following gastric resection for duodenal ulcer. While œsophageal stenosis is a rare complication of duodenal ulcer, the authors point out that it may occur. They emphasize the importance of œsophagoscopy and direct dilatation in treatment. The symptoms complained of are flatulence, substernal or epigastric distress, heartburn, nausea, regurgitation or vomiting; but as the lumen becomes narrow the outstanding symptom is difficulty in swallowing food, and later, with complete stenosis, there is regurgitation of liquids. The diagnosis is easily made by X rays and œsophagoscopy. The patient described by the authors had a gastric resection performed in the treatment of chronic duodenal ulcer, and when the œsophageal stricture occurred it was treated by œsophagoscopy under local anæsthesia with bougienage under direct vision through the œsophagoscope. The authors reiterate the dictum of the Jacksons that "blind bougienage should be discarded as an obsolete and very dangerous procedure".

Thrombophlebitis.

JOHN HOMANS (*The New England Journal of Medicine*, April 7, 1938) discusses the subject of thrombophlebitis of the lower extremities. He enumerates the principal factors favouring thrombosis as, first, inflammation of the vein wall, a factor of great potential importance little understood as yet and undoubtedly influenced by advancing years, secondly, changes in the blood itself, whether in the nature of depletion or related to the obscure influence of trauma, and thirdly, the slowing of the venous return from the legs, dependent upon confinement to bed and aggravated by increased abdominal tension. Such factors tend to cause thrombosis in certain especially susceptible vessels, notably the femoral and iliac veins and those of the calf and popliteal space. In his discussion the author expresses his conviction that thrombosis is encouraged to spread by slowing of the current of blood, and heals when a vigorous venous return from the diseased part is produced. In both preventive and therapeutic treatment he insists that gentle movement should be instituted at the earliest possible moment. In established thrombosis the return of blood from the lower limbs and the pelvis must be encouraged. Thus he advises elevation of the foot of the bed, abolition of the reclining position, application of heat rather than cold, and the permission of reasonable freedom rather than immobilization. In advocating this form of treatment he does not ignore the danger of embolism, but he is sure that immobilization does not ensure that the thrombus may not become detached, and describes the patient's use of a bed-pan as an athletic feat. He is equally certain that the principles he enunciates assist the thrombophlebitis in healing. Finally, he makes mention of the work of Best and his associates, who have used purified heparin as a preventive measure after operation on patients in whom it is considered that thrombosis might become a complication.

Peritonitis.

J. SHELTON HORSLEY (*Archives of Surgery*, February, 1938) writes a long paper on the subject of peritonitis. Under the section of treatment he mentions the intraperitoneal injection of preparations with a view to establishing local immunity. He discusses different preparations and considers that "Colibactragen" is "doubtless helpful in preventing peritonitis, but is not effective in the treatment of established peritonitis". In describing the treatment of acute appendicitis he advises the surgeon to operate at any stage as soon as the diagnosis is made, to make a McBurney incision through which the appendix may be approached and drainage, if necessary, established, to remove the appendix, and to use suction to remove pus or exudate. In his opinion gauze should not be placed within the peritoneal cavity and on no condition should the surgeon sponge away the pus or the exudate; the stump of the appendix should be treated simply, by being merely tied and disinfected; it should not be buried. He advises the surgeon to give the bowel rest by refraining from protoclysis and enemas at all times and by supplying water, electrolytes and calories by continuous intravenous injection of 5% dextrose in Ringer's solution. In the treatment of the distention and the adynamic ileus that accompany peritonitis he mentions the introduction of a tube into the stomach and continuous intravenous injection of a 5% solution of dextrose. He recommends the hypodermic administration of morphine, as Orr, Ochsner and others have demonstrated experimentally that morphine stimulates the tone, rhythmic contraction and in some degree peristaltic waves of the small intestine for a period of at least six hours.

Biliary Disease in Young Subjects.

ALFRED H. PORTER (*Surgery, Gynæcology and Obstetrics*, March, 1938) is convinced that gall-bladder disease in children is no longer a pathological curiosity of little or no importance. He contends that if gastro-intestinal disturbances, icterus and other symptoms in children received the same consideration that like symptoms receive in adults, many cases of gall-bladder disease would not escape recognition. Further, he considers that, at the present time, gall-bladder surgery in children is several years in arrears of the recognition of symptoms. The diagnosis of biliary tract disease in children is not difficult if the condition is suspected and the customary clinical and laboratory tests are applied. Many patients submitted to appendicectomy may be suffering from associated gall-bladder disease. The most effective means of arriving at a correct diagnosis of biliary tract disease, if it is suspected in children, appears to be cholecystography. The author then relates the histories of six patients under the age of twelve years, investigation of whose condition revealed biliary tract disease. On one patient, a boy, aged seven and a half years, cholecystectomy was performed for acute cholecystitis and cholelithiasis; it was also performed on a girl, aged nine years, with chronic cholecystitis with hydrops.

British Medical Association News.

SCIENTIFIC.

A MEETING of the Victorian Branch of the British Medical Association was held on April 6, 1938, at the Medical Society Hall, East Melbourne, DR. J. P. MAJOR, the President, in the chair.

Radiology of the Heart.

DR. L. E. ROTHSTADT read a paper entitled "The Radiological Examination of the Heart" (see page 116).

DR. E. L. COOPER demonstrated a number of pathological specimens illustrating some of the conditions described by Dr. Rothstadt.

An old museum specimen from the late Sir Harry Allen's collection showed rheumatic mitral valvulitis with thickening and stenosis of the mitral orifice. The papillary muscles were fibrosed and the *chordæ tendineæ* shortened. A thrombus had formed in the left auricle, becoming a "ball" thrombus which had been displaced, and, blocking the mitral orifice, had caused the sudden death of the patient.

Another specimen showed an extreme hypertrophy of the wall of the left ventricle following obstruction of the conus of the left ventricle by a congenital subaortic stenosis.

Dr. Cooper then demonstrated a specimen of extreme hypertrophy of the left ventricle contrasting with the thin-walled right ventricle in a heart removed from a patient with aortic stenosis due to an old rheumatic infection. The aortic valve segments had disappeared, becoming fused together and calcified, leaving a narrow slit for the escape of blood.

Another specimen was the heart of a child who had died during an attack of acute rheumatism. Small vegetations were seen on both the mitral and aortic valves at the line of attrition. The myocardium was involved and the ventricle and auricle were dilated. Death was due to cardiac failure.

The next exhibit showed a diffuse syphilitic involvement of the aorta, with pronounced thickening of the media and wrinkling of the intima. The patient had died during the course of antisyphilitic treatment with mercury and bismuth. Evidence of bismuth poisoning was obtained from the liver and kidney. Dr. Cooper also demonstrated a large aneurysm above the aortic valves, with thickening of the aortic cusps and occlusion of the coronary orifices. The ventricle was dilated but not hypertrophied.

In another specimen Dr. Cooper showed a large aneurysm of the arch of the aorta, which compressed the trachea and œsophagus. During life the aneurysm was not seen to pulsate when the chest was examined by means of fluoroscopy. A second jar contained the clot which had almost filled the aneurysm. Through the centre of the clot ran a narrow canal, of approximately the same diameter as the normal aorta. The thickness of the clot was the explanation of the absence of pulsation.

Dr. Cooper also showed a large aneurysm of the wall of the left ventricle, partly filled with laminated clot. The aneurysm had followed fibrosis of the myocardium consequent upon occlusion of a coronary vessel.

Dr. Cooper concluded the demonstration by showing a specimen of congenital coarctation of the aorta with a patent *ductus arteriosus*; the patient had lived to adult life with relatively few symptoms. The left ventricle was hypertrophied.

DR. C. H. FITTS expressed his appreciation of Dr. Rothstadt's paper, and said that he could vouch for the meticulous care which Dr. Parkinson took to obtain the detail which he wished to demonstrate in his teleradiograms. Parkinson had emphasized the fact that there were no standard oblique positions, but that the patient had to be manœuvred under fluoroscopic vision until, for instance, the left auricle or the aorta could be seen most favourably, and films should be taken in those exact positions. It sometimes happened that the aorta was best seen in the true lateral position. Dr. Fitts said that Dr. Parkinson's films least deserved the criticism of Roesler that teleradiograms were to fluoroscopy as a picture postcard to a ride through the country.

Speaking of radiology and the clinical examination of the heart, Dr. Fitts said that he thought a debt was owed to radiology for the substitution of the term "cardiac enlargement" for the more nebulous terms "hypertrophy" and "dilatation". Unfortunately students still read, and believed, that when the apex beat was displaced downwards the heart was hypertrophied and that when it moved out dilatation was indicated; they thus took to themselves powers of diagnosis which radiology or at times even autopsy could not equal. Dr. Fitts wondered how the question of enlargement of the heart was to be settled clinically. With so many imponderable factors, as had been demonstrated by Dr. Rothstadt, it would be foolish not to recognize the difficulties besetting even the evaluation of the importance of the position of the apex beat. Dr. Fitts said that he regarded the measurement of the apex beat from the midsternal line as one of the most impure forms of medical mathematics. Sometimes the measurement was made with the aid of a tape measure, but often it was made with the unaided eye; and such a measure could be of little value when unrelated to the size and configuration of the patient. He remembered having seen the orthodiagram of Carnera, the boxer, with the apex beat probably six inches from the mid-line; nevertheless, case reports were published with the bald statement that the apex beat was so many inches or centimetres from the mid-line, and the poor student was supposed to make some deduction from a similar statement in a commentary. Perhaps even those who made the measurements took a surreptitious glance at the position of the apex beat in relation to the nipple line, and fortified themselves with that knowledge. It might be contended that a measurement was of value for purposes of comparison with a later examination; but in face of the variations in standards which Dr. Rothstadt had shown it seemed unlikely that that could be so.

Of right cardiac dulness, Dr. Fitts said that he had had the opportunity of comparing the results of his percussion with orthodiagrams, and he felt that for himself the percussion of right cardiac dulness had no value. With reference to the decision of the important question as to whether the heart was enlarged or not, he said that he himself relied on the position of the apex beat in relation to the nipple line, and to the size and configuration of the chest. He felt too, and rightly so, that he might already be prejudiced by the history he had obtained and by the rest of the examination. If the apex beat was neither visible nor palpable, he liked to examine the patient by fluoroscopy.

Dr. Fitts then paid a tribute to some penetrating observations made at the end of the last century by Dr. Graham Steell, and pointed out how they had subsequently been borne out by radiological studies of the heart. Dr. Rothstadt's films also showed the value of this method in the examination of the great vessels, for the aorta could be seen in the whole of its thoracic extent as well as much of the trunk and some of the branches of the pulmonary artery. Dr. Fitts thought that radiology had a general value, in that it sharpened the sense of proportion in the use of some physical signs and aided prognosis.

In criticizing radiology in heart disease, Dr. Fitts pointed out that mitral stenosis might be present and yet little or no evidence might be given by radiology; or that a large heart might cause displacement of the œsophagus, so that the unwary might be deceived into a diagnosis of mitral stenosis, particularly if gallop rhythm was present. He thought that it was unfortunate that so many cardiac lesions were in combination: that mitral stenosis and aortic incompetence should be associated, and the myocardium and pericardium be involved indefinably in the same infection; that even thyreotoxicosis might be accompanied by hypertension, and that the hypertensive subject could be a prey to coronary sclerosis and occlusion; that even when they wished to study the enlargement of the heart in failure, they were in doubt as to how much a

small pericardial transudate might have altered the picture.

Dr. Fitts mentioned two other problems of moment: first, that there was a widespread belief that coronary arterial disease played no part in the production of cardiac enlargement in the absence of hypertension. That was a generalization which was removed from the truth, and in unexplained enlargement in people over forty years of age disease of the coronary arteries should be seriously considered. That view was held by Palmer in spite of his findings in an earlier series of cases. Dr. Fitts thought also that in recent years students of cardiology had been too much preoccupied with the cold gradations of decay, and that the study and the diagnosis of coronary arterial disease had run riot. The study of the end-results of disease did not lead to any useful purpose unless it led to a more eager study of the genesis of disease. There could not be any value in the contemplation of the third and last attack of congestive failure in rheumatic heart disease if the child in the first attack of acute rheumatism was not viewed by the medical man with fresh resolve. Radiology could not help there, unless to dispose of the fallacy that the apex beat moved out with the acute attack and in again as it subsided; the heart could be actively affected with the apex beat still in its normal position. The problem of rheumatic heart disease far outweighed in importance that of coronary arterial disease.

DR. D. THOMAS said that Melbourne owed a great deal to the teaching of the London cardiologists, of which the paper was a very able and faithful reflection. For many years he had been interested in the matter of the accurate determination of cardiac outline, and had found the greatest possible help from the use of those very methods. Unfortunately, in coronary disease there was no alteration in cardiac outline *per se*. In those cases he had found Röntgen-kymography of very real help. By that method it was possible to record the whole cardiac cycle in wave form and to measure the range of movement in the individual heart chambers, which could be readily identified. It was relatively simple to show that cardiac failure did not necessarily involve alteration in the size of the heart; on the other hand, gross alteration in the wave form did occur. He had examined several patients by the method, soon after the development of a myocardial infarct. The area of the heart most commonly involved was the apical portion of the left ventricle, either anteriorly or posteriorly. The kymograph made it possible to sort out shadows in or near the hilum of the lung.

Dr. Thomas showed a number of lantern slides of the kymography of various conditions, such as mediastinal fibroma and leuchæmia, in which extraneous masses obscured the outline of a heart in which coronary occlusion existed.

DR. W. W. OSTERMEYER pointed out that discrimination between the external and internal diameters of the heart had not yet been achieved by radiological methods. It was generally recognized that it was important to ascertain whether actual enlargement of the heart existed, and he wished to draw attention to the value of an appreciation of strength of the apex beat as an indication of hypertrophy, and of weakness of the apex beat as an indication of dilatation of an enlarged heart. Ascertainment of the systolic blood pressure and particularly of the pulse pressure also, helped to discriminate between enlargement of the cavity inside and enlargement of the walls of the heart. It was also desirable that they should know whether the heart threw all the blood out at each systole.

DR. G. A. PENINGTON said that despite what had been shown that night it was not possible for the majority of physicians to resort to the measures that had been discussed, and it was still essential to perfect the ascertainment and interpretation of physical signs and to teach students to do so. It was possible by the use of inspection alone to determine a tremendous amount. In fixing the position of the apex beat some guide could be obtained; the site of the apex beat was the lowest and leftmost point of direct lift or thrust against the examining finger.

Dr. Rothstadt, in reply, said that by radiological examination it was not possible to separate dilatation and hypertrophy, nor was that particularly to be desired; but the fact of enlargement could be established. He agreed with Dr. Ostermeyer that a good deal of information could be obtained from an appreciation of the strength of the apex beat. It had not been Dr. Rothstadt's intention to decry the importance of physical signs, but the methods he had described were of value in checking and enhancing the interpretation placed on physical signs. Any method it was possible to evolve should be used to arrive at the truth.

NOMINATIONS AND ELECTIONS.

THE undermentioned have been elected members of the New South Wales Branch of the British Medical Association:

Brown, Maxwell Mansfield, M.B., B.S., 1938, B.Sc., 1933 (Univ. Sydney), Manly District Hospital, Manly.

Lancaster, Henry Oliver, M.B., 1937 (Univ. Sydney), Sydney Hospital, Sydney.

Davey, Patricia Reeves, M.B., B.S., 1938 (Univ. Sydney), Saint Joseph's Hospital, Auburn.

Macindoe, Philip Hudson, M.B., B.S., 1935 (Univ. Sydney), F.R.C.S. (Edinburgh), 1937, 135, Boulevarde, Strathfield.

Rainbow, James Manning, M.B., Ch.M., 1924 (Univ. Sydney), 231, Macquarie Street, Sydney.

The undermentioned has been reelected a member of the New South Wales Branch of the British Medical Association:

Dawson, Elsie Joan, M.B., 1922 (Univ. Sydney), 133, De Boos Street, Temora.

National Health Insurance.

THE NATIONAL HEALTH AND PENSIONS INSURANCE ACT.

THE following important clauses of the *National Health and Pensions Insurance Act* are published for the information of medical practitioners.

Definition of Medical Practitioner.

"Medical practitioner" means a person who is registered, or entitled to practise, as a medical practitioner under the law in force in any State or part of the Commonwealth.

Medical Benefit.

47. Medical benefit consists of such proper and necessary medical services as are prescribed and the provision of proper and sufficient drugs and medicines and of the prescribed medical and surgical appliances and the supply of such medical certificates as are required for the purposes of this Act, but does not include medical services involving the exercise of such special skill or experience as general medical practitioners cannot reasonably be expected to possess or treatment or attendance in respect of a confinement or such other medical services as are prescribed.

48. A juvenile contributor shall, notwithstanding that he has ceased to be employed, be entitled to medical benefit until the thirtieth day of June or the thirty-first day of December, as the case may be, whichever next follows the date on which he attains the age of sixteen years and six months.

49.—(1.) A person shall not be disqualified from receiving medical benefit under this Act by reason that his sickness has been caused by his own misconduct.

(2.) A voluntary contributor whose total income from all sources exceeds Three hundred and sixty-five pounds per annum shall not be entitled to medical benefit.

50. Where an insured person who is entitled to medical benefit attains the maximum age and is or becomes entitled to receive an old-age pension, he shall be entitled to receive medical benefit during the remainder of his life.

51.—(1.) The Commission may, as prescribed, make arrangements whereby medical services in accordance with this Act and the Regulations will be supplied by medical practitioners to insured persons.

(2.) The Commission may, as prescribed, enter into contracts or agreements with medical practitioners by whom medical services are to be supplied under any arrangement made under the last preceding sub-section.

(3.) Any medical practitioner may, subject to the prescribed conditions, secure participation in an arrangement made under sub-section (1.) of this section.

(4.) A list shall be prepared and published as prescribed, from time to time, showing the names of the medical practitioners who are parties to any contract or agreement made under this section in respect of any State or part of the Commonwealth.

(5.) Any insured person may, subject to the prescribed conditions, select from the appropriate list the medical practitioner by whom he desires that medical services shall, subject to the consent of that practitioner, be supplied to him.

(6.) Medical services shall be supplied to an insured person who has not made a selection under the last preceding sub-section, or to whose selection the selected medical practitioner has not consented, by such medical practitioner on the appropriate list as is selected by the Commission in the prescribed manner.

52. If the Commission is satisfied that an arrangement made under section fifty-one of this Act in respect of any State or part of the Commonwealth is unsatisfactory or is inadequate to provide medical services or that no satisfactory and adequate arrangement can be so made, the Commission may suspend or cancel any existing arrangement and make such other provision for the supply of medical services as it thinks fit, or it may suspend, for such period as it thinks fit, in respect of insured persons in that State or part of the Commonwealth, their right to receive medical services and may provide for the payment, to each insured person affected by the suspension, of the whole or part of a sum, bearing the same proportion to the amount specified by the Commission as being the annual cost at the time of supplying medical services to an insured person, as the period of suspension bears to a year.

53.—(1.) The Commission may, as prescribed, enter into contracts or agreements for the supply to insured persons of proper and sufficient drugs and medicines and of such appliances as are prescribed, where such drugs, medicines and appliances are ordered by any medical practitioner attending an insured person under and in accordance with this Act.

(2.) Such drugs, medicines and appliances shall be supplied by persons with whom the Commission has entered into a contract or agreement under the last preceding sub-section.

(3.) No contract or agreement under this section shall be made with any person unless—

(*a*) he is a pharmaceutical chemist; or

(*b*) he undertakes that all medicines supplied shall be dispensed by or under the direct supervision of a pharmaceutical chemist:

Provided that, in such special circumstances or cases as are prescribed, but not otherwise, a contract or agreement may be made with a medical practitioner for the supply by him of drugs or medicines to an insured person.

(4.) A list shall be prepared and published as prescribed, from time to time, showing the names of persons who are parties to any contract or agreement made under this section in respect of any State or part of the Commonwealth.

(5.) Any person with whom the Commission may enter into a contract or agreement under this section may, subject to the prescribed conditions, secure participation in the supply of drugs, medicines and appliances to insured persons, subject to his entering into such a contract or agreement.

54.—(1.) If the Commission is satisfied, after such inquiry as is prescribed, that a contract or agreement made under section fifty-one or section fifty-three of this Act should, in the interests of insured persons, be cancelled, it may cancel the contract or agreement, and its action shall be final and without appeal.

(2.) Where the Commission has cancelled any contract or agreement made under section fifty-one or section fifty-three of this Act, the person with whom the contract or agreement was made shall not be entitled, unless and until the Commission otherwise determines, to participate in any arrangement, contract or agreement under this Part.

55. Where the Commission—

(*a*) has cancelled a contract or agreement made under this Part for the supply of drugs, medicine and appliances; or

(*b*) is satisfied that, in respect of any State or part of the Commonwealth, it is impracticable to make a satisfactory contract or agreement under section fifty-three of this Act for the supply of drugs, medicines and appliances,

the Commission may make, in lieu of the contract or agreement so cancelled or in respect of that State or part of the Commonwealth, as the case may be, such other provision as it thinks fit for the supply to insured persons of drugs, medicines and appliances.

56.—(1.) For the purpose of enabling the Commission to determine the terms of any contract or agreement proposed to be entered into by it under this Part for the supply of drugs, medicines and appliances, the Commission may, by notice in writing, call upon any manufacturer or wholesale distributor of drugs, medicines and appliances to furnish to it, within such time as is specified in the notice, such books and documents and such information as the Commission thinks necessary in relation to drugs, medicines and appliances the subject of any such contract or agreement.

(2.) Any person who, without reasonable excuse (proof whereof shall lie upon him) fails, after receipt of a notice under the last preceding sub-section, to comply with the requirements of the notice, shall be guilty of an offence.

Penalty: Fifty pounds, or imprisonment for three months.

57.—(1.) For the purposes of this Act, there shall be a Medical Benefit Council consisting of—

(*a*) persons representing—

(i) medical practitioners rendering services under this Act;

(ii) pharmaceutical chemists (including pharmaceutical chemists representing friendly societies' dispensaries) supplying drugs, medicines and appliances under this Act;

(iii) employers of insured persons; and

(iv) insured persons who are members of approved societies; and

(*b*) persons selected by the Minister.

(2.) Each member of the Medical Benefit Council shall be appointed by the Minister and shall hold office for such period and upon such conditions as are prescribed.

(3.) The number of persons to be selected by the Minister, and the number of persons representing each class specified in sub-section (1.) of this section, to be appointed members of the Medical Benefit Council, and the method of selecting the persons to be appointed as representing each such class shall be as prescribed.

(4.) The Medical Benefit Council shall give advice to the Commission with respect to any matter relating to medical benefit which is referred to it by the Commission, and shall have such other powers and duties as are prescribed.

58. The Commission may, after consultation with the Medical Benefit Council, decide whether or not any substance or preparation is, for the purposes of this Act, a proper or sufficient drug or medicine.

59.—(1.) For the purposes of this section, the Commission may divide the Commonwealth into districts.

(2.) The Commission may, subject to and in accordance with the Regulations, establish a District Medical Benefit Committee in any such district.

(3.) A District Medical Benefit Committee shall have—

(a) such powers and duties in relation to complaints by insured persons, medical practitioners, pharmaceutical chemists, friendly societies' dispensaries and approved societies in connexion with medical benefit in the district for which it is appointed; and

(b) such other powers and duties,

as are prescribed.

60. If a Medical Practitioners Committee is appointed by medical practitioners, the Commission may, if it considers the Committee to be representative of the medical practitioners in the Commonwealth who are parties to such contracts or agreements, refer to the Committee for report matters relating to the administration of medical benefit under this Act, and shall consider any representations relating to such administration which are made by such medical practitioners and submitted to the Commission through the Committee.

61. If a Pharmaceutical Chemists Committee is appointed by pharmaceutical chemists, the Commission may, if it considers the Committee to be representative of the pharmaceutical chemists and friendly societies' dispensaries in the Commonwealth who are parties to such contracts or agreements, refer to the Committee for report matters relating to the administration of medical benefit under this Act, and shall consider any representations relating to such administration which are made by such pharmaceutical chemists and friendly societies' dispensaries and submitted to the Commission through the Committee.

Medical Benefit Account.

118.—(1.) There shall be kept in the Health Insurance Fund an account to be called the Medical Benefit Account to which shall be credited from time to time, out of the moneys standing to the credit of the Health Insurance Fund, such amounts as are, in the opinion of the Commission, necessary to meet the cost of medical benefit under this Act.

(2.) The cost of medical benefits under this Act shall be met out of amounts from time to time standing to the credit of the Medical Benefit Account.

Insurable Employment.[1]

(a) Employment in Australia under any contract of service or apprenticeship, written or oral, whether expressed or implied, and whether the employed person is paid by the employer or some other person, and whether under one or more employers, and whether paid by time or by the piece or partly by time and partly by the piece, or otherwise, or without any money payment.

(b) Employment under such a contract as aforesaid as master or a member of the crew who is either domiciled or has a place of residence in Australia of any British ship of which the owner, or, if there is more than one owner, the managing owner or manager, resides or has his principal place of business in Australia.

(c) Employment in Australia as an outworker, except in so far as such employment is excluded by the Regulations.

The expression "outworker" means a person to whom articles or materials are given out by another person to be made up, cleaned, washed, altered, ornamented, finished, repaired or adapted for sale for the purposes of the trade or business of that other person where the process is to be carried out either in the home of the outworker or in some other premises not being premises under the control and management of that other person.

The person who gives out the articles or materials shall, in relation to the person to whom they are given out, be deemed to be the employer of that person for the purposes of this Act, but the Commission may, by special order, provide that as respects any outworkers or any class of outworkers specified in the order a person specified in the order shall, instead of the person who gives out the articles or materials, be deemed to be the employer and thereupon that person shall be deemed to be the employer.

(d) Employment in Australia of such classes as the Commission specifies by special order, being cases in which a person undertakes otherwise than by a contract of service the performance either wholly or in part by himself of manual labour in relation to a trade or business carried on by the person for whom the labour is performed. The person for the purposes of whose trade or business the labour is performed shall, in relation to the person so undertaking to perform the labour, be deemed to be the employer of that person for the purposes of this Act.

(e) Employment in Australia by or under any authority under the Commonwealth or a State constituted by or under any Act or State Act, except in so far as such employment is excluded by the Regulations.

(f) Employment in Australia in plying for hire with any vehicle or vessel the use of which is obtained under any contract of bailment in consideration of the payment of a fixed sum or a share in the earnings or otherwise, and the person from whom the use of the vehicle or vessel is so obtained shall be deemed to be the employer for the purposes of this Act.

Excepted Employment.[2]

(a) Employment, except as prescribed, in the permanent Naval, Military or Air Forces of the Commonwealth.

(b) Employment—

(i) by the Commonwealth or a State;

(ii) by any authority under the Commonwealth or a State constituted by or under any Act or State Act; or

(iii) of a permanent nature by any corporation constituted by any Act or State Act,

in respect of which the Commission has certified, by a certificate which remains in force, that the terms of the employment provide benefits corresponding to, and on the whole not less favorable than, any of the following classes of benefits provided by this Act:—

(iv) health insurance benefits;

(v) health insurance benefits together with old-age pensions;

(vi) health insurance benefits, old-age pensions, widows' pensions and orphans' pensions.

The Commission shall not issue a certificate under this paragraph in respect of employment by any authority under the Commonwealth or under a State or any corporation constituted by any Act or State Act, unless it is satisfied that the provision by the authority or corporation of benefits in respect of which the certificate is given is guaranteed by the Government of the Commonwealth or of a State.

(c) Employment as an agent paid by commission or fees or a share in the profits, or partly in one and partly in another of such ways, where the person so employed is mainly dependent for his livelihood on his earnings from some other occupation, or where he is ordinarily employed as such agent by more than one employer, and his employment under no one of such employers is that on which he is mainly dependent for his livelihood.

[1] Part I of the First Schedule.

[2] Part II of the First Schedule.

(*d*) Employment otherwise than by way of manual labour—

(i) At a rate of remuneration exceeding in value Three hundred and sixty-five pounds a year;

(ii) in cases where such remuneration is in respect of part time service only—at a rate of remuneration which, in the opinion of the Commission, is equivalent to a rate of remuneration exceeding Three hundred and sixty-five pounds a year for whole time service; or

(iii) in cases where the remuneration is in whole or in part of varying amount and the rate of remuneration is accordingly not immediately ascertainable—at a rate of remuneration which, as estimated by the Commission by reference to the remuneration earned by the employee in the same employment during the last preceding year, or to any other circumstances which appear to the Commission to be relevant, exceeds in value Three hundred and sixty-five pounds a year.

(*e*) Employment of a casual nature, not being—

(i) employment for the purposes of the employer's trade or business; or

(ii) employment for the purposes of any game or recreation where the persons employed are engaged or paid through a club, in which case the club shall, for the purposes of the Act, be deemed to be the employer.

(*f*) Employment of any class which is specified in the Regulations as being of such a nature that it is ordinarily engaged in as subsidiary employment only and not as the principal means of livelihood.

(*g*) Employment in the service of the husband or wife of the employed person, and employment without money payment in the service of a prescribed relative of the employed person.

(*h*) Employment for the purposes of a business of which, within a prescribed period before the employment began, the employed person was owner or part owner, if the employment is by a prescribed relative or, as prescribed, by a proprietary company of which relatives are members.

(*i*) Employment in respect of which the Commission has certified, by a certificate which remains in force, that, on account of the remoteness of or any other circumstance related to the locality or nature of the employment, the effective administration of health insurance benefits or of the other benefits provided by this Act or of all the benefits so provided in respect of that employment is impracticable.

(*j*) Employment of such classes and in such areas as are prescribed.

(*k*) Employment of aboriginal natives of the islands of the Pacific under such conditions and in such localities as are determined by the Commission, and employment of aboriginal natives of Australia under such conditions and in such localities as are so determined, after report from the authority of the State or Territory in which the natives are employed, which is responsible for the protection of those natives.

Post-Graduate Work.

THE MELBOURNE PERMANENT POST-GRADUATE COMMITTEE.

LECTURES BY DR. W. B. CASTLE.

THE Melbourne Permanent Post-Graduate Committee announces that Dr. W. B. Castle, of the Thorndyke Memorial Laboratory, Boston City Hospital, United States of America, will deliver a series of lectures at the Medical Society Hall, 426, Albert Street, East Melbourne, on August 15, 17, 19, 22, 24 and 26, 1938, commencing at 8.30 p.m. The programme is as follows:

August 15: "Pathological Physiology and Classification of Anæmias".
August 17: "Diagnosis and Treatment of Anæmias".
August 19: "Ætiology of Nutritional Deficiency Anæmias".
August 22: "Hæmorrhagic Diseases".
August 24: "General Considerations in Vitamin Deficiencies".
August 26: "Clinical Manifestations of Vitamin Deficiencies".

The fee is three guineas.

REFRESHER COURSE.

A refresher course has been arranged. It will include the lectures by Dr. W. B. Castle. The programme (excluding Dr. Castle's lectures) is as follows:

Monday, August 15.

Royal Melbourne Hospital.

9.15 a.m.—Registration at Post-Graduate Office, Royal Melbourne Hospital.
10 a.m.—Dr. S. O. Cowen: "The Clinical Significance of Œdema and its Treatment".
11.30 a.m.—Dr. Ian J. Wood: Practical demonstration of blood transfusion.
2.15 p.m.—Dr. Ivan Maxwell: "Endocrine Disorders".
3.45 p.m.—Dr. E. Hughes-Jones: Clinical demonstrations in septic wards.

Tuesday, August 16.

Alfred Hospital.

9.15 a.m.—Dr. R. A. Willis: Autopsy.
10 a.m.—Symposium on diseases of the chest: medical, Dr. W. S. Newton; bronchoscopic, Dr. A. Blaubaum; surgical, Dr. C. J. O. Brown.
2.15 p.m.—Dr. E. Downie: "Practical Points in the Treatment of Diabetes".
3.45 p.m.—Dr. Fay Maclure: "Painful Feet".

Wednesday, August 17.

Royal Melbourne Hospital.

9.15 a.m.—Dr. R. J. Wright-Smith: Autopsy.

Eye and Ear Hospital.

10 a.m.—Dr. A. S. Anderson: "When to Diagnose Glaucoma".
Dr. J. O'Brien: "Types of Conjunctivitis and their Treatment".
Dr. W. J. L. Duncan: "Types of Headache that Suggest Refractive Error".
11.30 a.m.—Dr. G. A. D. McArthur: "Treatment of Acute Infections of the Maxillary Sinus".
Dr. Jean Littlejohn: "Treatment of Discharging Ears".
Dr. N. Box: "Tonsillar Infections and their Treatment".
2.15 p.m.—Series of lectures and demonstrations by the staff of the Walter and Eliza Hall Institute at the Royal Melbourne Hospital, including the following:
Dr. F. M. Burnet: "Virus Research in Relation to Human Diseases".
Dr. R. J. Wright-Smith: Demonstration of pathological specimens.

Thursday, August 18.

Saint Vincent's Hospital.

9.15 a.m.—Dr. S. Bray: Autopsy.
10 a.m.—Symposium on diseases of the stomach.
Dr. J. G. Hayden: "Indigestion, Diagnosis and Treatment".
Dr. J. Horan: "Gastroscopy".
Dr. C. Osborn: "The Indications for Surgery in Gastro-Duodenal Disease".

Women's Hospital.

2.15 p.m.—Dr. A. M. Hill: "Puerperal Infections".
3.45 p.m.—Dr. Ivon Hayes: "Ante- and Post-Partum Hæmorrhage".

Children's Hospital.

8.15 p.m.—Meeting of the Pædiatric Society.

Friday, August 19.

Children's Hospital.

9.15 a.m.—Dr. Reginald Webster: Autopsy.
10 a.m.—Dr. Stewart Ferguson: "Dietetics and Diarrhœa in Infancy".
11.30 a.m.—Dr. J. G. Whitaker: "Pyloric Stenosis".

Royal Melbourne Hospital.

2.15 p.m.—Dr. S. V. Sewell: "The Application of Tests of Renal Function to Disease of the Kidneys".
3.45 p.m.—Sir Alan Newton: "Problems in Relation to Goitre".

Saturday, August 20.

Royal Melbourne Hospital.

9.15 a.m.—Dr. R. J. Wright-Smith: Autopsy.
10.30 a.m.—Dr. W. B. Castle: Clinical demonstration.

Sunday, August 21.

The Orthopædic Section, Children's Hospital, Frankston.[1]

10.30 a.m.—Dr. J. G. Whitaker: "Tuberculous Disease in Bones and Joints".
Dr. J. B. Colquhoun: Demonstration of plaster technique.
Dr. Eric Price: Ward round, illustrating common orthopædic conditions and their treatment.
Dr. Douglas Galbraith: "The Treatment of Poliomyelitis".
(The craft hostel and training workshop will be open for inspection during the visit.)

Monday, August 22.

Royal Melbourne Hospital.

9.15 a.m.—Dr. R. J. Wright-Smith: Autopsy.
10 a.m.—Dr. H. H. Turnbull: "The Mechanism and Treatment of Cardiac Pain".
11.30 a.m.—Dr. Allan Hailes: "Indications for Operation in Disease of the Gall-Bladder".
2.15 p.m.—Dr. Blois Lawton: "Recent Advances in Therapeutics".
3.45 p.m.—Dr. John Tait: "Infections of the Urinary Tract".

Tuesday, August 23.

Alfred Hospital.

9.15 a.m.—Dr. R. A. Willis: Autopsy.
10 a.m.—Dr. L. B. Cox: "Headaches".
11.30 a.m.—Dr. Hugh Trumble: "The Management of Head Injuries".
2.15 p.m.—Dr. C. H. Hembrow: "The Problem of Chronic Backache".
3.45 p.m.—Staff of the Baker Institute, Alfred Hospital: Clinical pathology.

Wednesday, August 24.

Royal Melbourne Hospital.

9.15 a.m.—Dr. R. J. Wright-Smith: Autopsy.

Women's Hospital.

10 a.m.—Dr. W. G. Cuscaden: "Cervical Malignancy".
11.30 a.m.—Dr. R. G. Worcester: "Gynæcological Endocrine Therapy".

Saint Vincent's Hospital.

2.15 p.m.—Dr. W. B. Castle: Clinical demonstration.

Thursday, August 25.

Children's Hospital.

9.15 a.m.—Dr. Reginald Webster: Autopsy.
10 a.m.—Dr. J. W. Grieve: "Common Ailments in Childhood—the Problem of the Child who Fails to Thrive".
11.30 a.m.—Dr. Douglas Stephens: "The Acute Abdomen in Childhood".

Infectious Diseases Hospital, Fairfield.

2.30 p.m.—Dr. F. V. Scholes and staff: Ward round.

[1] Arrangements for transport will be made during the course.

Friday, August 26.

Saint Vincent's Hospital.

9.15 a.m.—Dr. S. Bray: Autopsy.
10 a.m.—Dr. Eric Cooper: Practical demonstration of the use of diet in the treatment of common medical conditions.
11.30 a.m.—Dr. C. G. Shaw: "Surgical Conditions of the Large Bowel".
2.15 p.m.—Dr. John O'Sullivan: "The Uses and the Limitations of Radiology in Gastro-Intestinal Diseases".
3.45 p.m.—Dr. K. G. Colquhoun: "Common Dermatological Conditions".

Demonstrations of minor diagnostic procedures will also be arranged.

The fee for this course is three guineas. A limited amount of accommodation is available at the Royal Melbourne Hospital for those desiring it.

COURSE IN OBSTETRICS AND GYNÆCOLOGY.

A course in obstetrics and gynæcology will be held at the Women's Hospital from Monday, September 5, to Saturday, September 17, 1938. Accommodation at the Women's Hospital will be available for those attending the course.

The fee for this course will be three guineas. An additional fee of three guineas is charged by the hospital to cover cost of board and lodging.

Correspondence.

INFARCTION AND FIBROSIS OF THE HEART WALL.

SIR: I have just returned from abroad, and find that in my article under the above heading in THE MEDICAL JOURNAL OF AUSTRALIA, June 4, 1938, page 967, an unfortunate omission occurs in the third line, which should read "thirty-nine" examples instead of "nine". The context, of course, shows that thirty-nine are referred to.

Yours, etc.,
J. B. CLELAND.

The University of Adelaide,
July 7, 1938.

TUBERCULO-SILICOSIS.

SIR: In the journal of July 9, Dr. Moore describes a case of silico-tuberculosis and refers to the "acute" development of a silicosis.

Silicosis is essentially a process of chronic pulmonary fibrosis, and unless the word "acute" is applied to cases developing after five or six years' exposure to the hazard, it has no application to the condition.

From the history and skiagrams I should think that the case is one of acute tubercular spread of the exudative type (compare "Text Book of X-Ray Diagnosis", by Shanks, Twining and Kerley, 1938), and "X-Rays in Tuberculosis", by Bannen, 1937). It is a bronchopneumonic spread as opposed to a miliary one. It is very commonly seen in the large hospitals and sanatoria, although it may not be common in the practice of a clinic like that at Kalgoorlie.

If the patient recovers, most of the lung markings disappear, leaving some general fibrosis, with marked fibrosis in the region of the original apical lesion.

Yours, etc.,
J. G. EDWARDS.

"Craignish",
185, Macquarie Street,
Sydney.
July 11, 1938.

Corrigenda.

WE are informed that two errors have occurred in the issue of June 11. At page 1021, in Table XXI, in which anæsthetic fatalities at the Children's Hospital, Adelaide, are set out, the dates given are "October, 1931, to September, 1932". This should read "October, 1931, to September, 1936".

At page 1030 of the same issue, in Table XXVIII, the anæsthetic fatalities at the Children's Hospital, Melbourne, due to open ether anæsthesia, are given as four out of 2,703 cases. The percentage is stated to be 1·5; actually it should be 0·15.

Obituary.

JOAN TRENOW TAYLOR.

WE regret to announce the death of Dr. Joan Trenow Taylor, which occurred on July 10, 1938, at Sukkur, India.

GEORGE BAUR.

WE regret to announce the death of Dr. George Baur, which occurred on July 17, 1938, at Turramurra, New South Wales.

Books Received.

THE SEASONAL PERIODICITY OF MALARIA AND THE MECHANISM OF THE EPIDEMIC WAVE, by C. A. Gill, M.R.C.P., M.R.C.S., D.P.H., D.T.M. and H.; 1938. London: J. and A. Churchill Limited. Demy 8vo, pp 147, with a map and 17 illustrations Price: 10s. 6d. net.

THE PROCEEDINGS OF THE MEDICO-LEGAL SOCIETY OF VICTORIA DURING THE YEARS 1933-1934-1935-1936, edited by J. V. Barry and A. E. Coates, M.D., M.S., F.R.A.C.S.; Volume II; 1937. Melbourne: Brown, Prior, Anderson Proprietary Limited. Demy 8vo, pp. 179.

Diary for the Month.

JULY 26.—New South Wales Branch, B.M.A.: Medical Politics Committee.
JULY 27.—Victorian Branch, B.M.A.: Council.
JULY 28.—South Australian Branch, B.M.A.: Branch.
JULY 28.—New South Wales Branch, B.M.A.: Branch.
AUG. 2.—New South Wales Branch, B.M.A.: Organisation and Science Committee.
AUG. 3.—Western Australian Branch, B.M.A.: Council.
AUG. 3.—Victorian Branch, B.M.A.: Branch.
AUG. 4.—South Australian Branch, B.M.A.: Council.
AUG. 5.—Queensland Branch, B.M.A.: Branch.
AUG. 9.—New South Wales Branch, B.M.A.: Executive and Finance Committee.
AUG. 12.—Queensland Branch, B.M.A.: Council.
AUG. 16.—New South Wales Branch, B.M.A.: Ethics Committee.
AUG. 17.—Western Australian Branch, B.M.A.: Branch.
AUG. 18.—New South Wales Branch, B.M.A.: Clinical Meeting.
AUG. 23.—New South Wales Branch, B.M.A.: Medical Politics Committee.

Medical Appointments Vacant, etc.

For announcements of medical appointments vacant, assistants, *locum tenentes* sought, etc., see "Advertiser", pages xvi to xix.

CHILDREN'S HOSPITAL (INCORPORATED), PERTH, WESTERN AUSTRALIA: Junior Resident Medical Officers.

NAREMBEEN ROAD BOARD, NAREMBEEN, WESTERN AUSTRALIA: Medical Officer.

THE PRINCE HENRY HOSPITAL, SYDNEY, NEW SOUTH WALES: Medical and Surgical Fellowships.

Medical Appointments: Important Notice.

MEDICAL PRACTITIONERS are requested not to apply for any appointment referred to in the following table without having first communicated with the Honorary Secretary of the Branch named in the first column, or with the Medical Secretary of the British Medical Association, Tavistock Square, London, W.C.1.

BRANCHES.	APPOINTMENTS.
NEW SOUTH WALES: Honorary Secretary, 135, Macquarie Street, Sydney.	Australian Natives' Association. Ashfield and District United Friendly Societies' Dispensary. Balmain United Friendly Societies' Dispensary. Leichhardt and Petersham United Friendly Societies' Dispensary. Manchester Unity Medical and Dispensing Institute, Oxford Street, Sydney. North Sydney Friendly Societies' Dispensary Limited. People's Prudential Assurance Company Limited. Phœnix Mutual Provident Society.
VICTORIAN: Honorary Secretary, Medical Society Hall, East Melbourne.	All Institutes or Medical Dispensaries. Australian Prudential Association, Proprietary, Limited. Mutual National Provident Club. National Provident Association. Hospital or other appointments outside Victoria.
QUEENSLAND: Honorary Secretary, B.M.A. House, 225, Wickham Terrace, Brisbane, B.17.	Brisbane Associate Friendly Societies' Medical Institute. Proserpine District Hospital. Members accepting LODGE appointments and those desiring to accept appointments to any COUNTRY HOSPITAL are advised, in their own interests, to submit a copy of their Agreement to the Council before signing.
SOUTH AUSTRALIAN: Secretary, 178, North Terrace, Adelaide.	All Lodge appointments in South Australia. All contract Practice Appointments in South Australia.
WESTERN AUSTRALIAN: Honorary Secretary, 205, Saint George's Terrace, Perth.	All Contract Practice Appointments in Western Australia.

Editorial Notices.

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